The MINING CONGRESS JOURNAL

Volume 14 MAY, 1928 *No.* 5

ANNUAL COAL CONVENTION AND EXPOSITION EDITION

Fifth Annual Convention
Coal Operating Men
Cincinnati, Ohio, May 7-11

In This Issue:

Poor Old King Coal
Safety at the Madison Coal Corporation
Reducing Accidents Due to Blasting Caps
Safety Work at United Verde

Mechanical Loading With Shaking Conveyors in Wyoming
New Operation of Great Valley Anthracite Corporation
British Coal Washing Practice
Research on Metals for Handling Coal Mine Waters

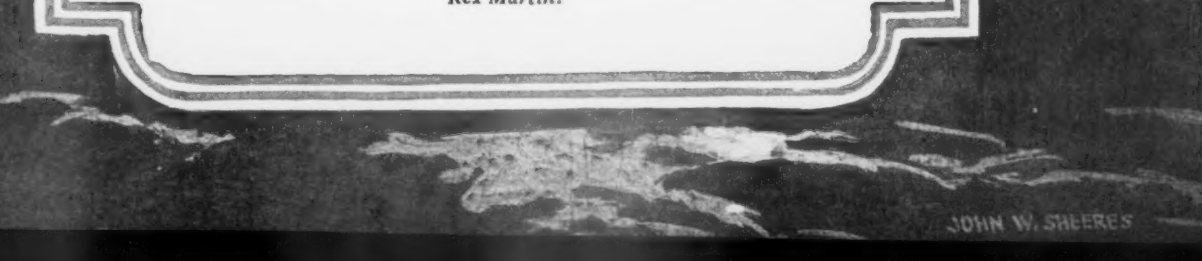
Mining Methods at Pilares Mine
Ventilation at Butte Mines of Anaconda

Work of American Zinc Institute
California Mineral Industries
The Tungsten Industry

The Annual Check-Up on Progress
Legislative Review

Contributors:

Thos. F. Downing, Jr., F. J. Byrne, W. V. DeCamp, O. G. Sharrer, H. B. Cooley, J. S. Drinkwater, W. A. Selvig, V. A. Brussolo, A. S. Richardson, Stephen S. Tuthill, J. M. Friedlander, Nelson Franklin, Rex Martin.



Note rough surface of wrought iron which soaks up the zinc and holds it in a vise-like grip, so that the coating won't flake or peel off.

Note relatively smooth surface of steel, giving such poor anchorage for zinc that it flakes and peels off in handling and wear.

Facts you should know about Galvanized Pipe

IN power and industrial plants, large buildings, etc. galvanized pipe should, and does, find extensive application for water supply, plumbing, drinking water lines, and many other services.

The advantage of rust resistance possessed by Byers Black pipe is still further emphasized when it is galvanized. This is so because the galvanized coating on Byers Pipe not only is much **heavier** than on cheaper pipe, but it **adheres** more firmly to the base metal. The question of adhesion, or freedom from flaking or scaling off, is always important in determining the value of any protective coating. The superiority of Byers Pipe in this respect can be quickly and easily demonstrated by anyone who is interested in the subject.

Make this Test!

Take a short piece of Byers galvanized pipe and hammer it flat. Note how the zinc sticks firmly to the metal—no sign of scaling or flaking. Then cut off a short piece of cheaper galvanized pipe, and note, first, how the galvanizing peels off from the ends when cut, and secondly how it peels from all over the surface when hammered flat. (see photos)

Byers galvanized pipe hammered flat, without showing tendency of coating to flake or peel off.

Other pipe submitted to same test as shown above. Note how galvanizing comes off in big flakes.

Why zinc sticks to Byers

Byers Pipe, when "pickled" prior to galvanized, becomes deeply etched so as to resemble wood furrowed by exposure to the weather. This uneven etching is due to the silicate slag filaments **found only in genuine wrought iron.** The rough surface of wrought iron not only soaks up an extra amount of zinc, but affords a much better anchorage than the relatively smooth surface of steel. (see photo micrographs above). These are the simple, easily demonstrated reasons why Byers galvanized pipe is so greatly superior to galvanized pipe made from cheaper base metal. For further information, ask for Byers Bulletin No. 42.

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The MINING CONGRESS JOURNAL

VOLUME 14 | MAY, 1928 | No. 5

Contents

EDITORIALS

	Page
May Seven to Eleven	293
Beating the Standard	293
Management and Safety Problems	293
Power and Transportation	293
Clean Coal	293
Mechanized Mining	293
Progress in Mechanized Mining	293
Modern Methods	294
Statistics on Mechanized Loading	294
Tax Revision	294
Undeveloped Mineral Resources	294
Another Contribution to Industry	294
Fields for Research	295
Has the Dollar Replaced the Gold Standard?	295
Why Not?	295
Rights Transgressed	296
The Investigation Continues	296
West Virginia to the Front	296
Records of Performance	296
The End in Sight	296
An Industrial Problem	296

FEATURE ARTICLES

Fifth Annual Convention, Practical Coal Operating Men	297
Poor Old King Coal—By Thos. F. Downing, Jr.	305
Safety Organization and Methods of the Madison Coal Corporation—By H. T. Bannister	311
Reducing Accidents Due to Careless Handling of Blasting Caps—By F. J. Byrne	315
Safety Work at United Verde—By W. V. DeCamp	317
The Tungsten Industry—By Nelson Franklin	319
The Work of the American Zinc Institute—By Stephen S. Tuthill	320
Promoting and Defending California's Mineral Industries—By J. M. Friedlander	322
The Annual Check-Up on Progress—By Rex Martin	324
Legislative Review	325
Review of the Mechanization Survey—By G. B. Southward	328
Mechanical Loading with Shaking Conveyors in Southern Wyoming—By O. G. Sharrer	330
New Operation of the Great Valley Anthracite Corporation—By H. B. Cooley	335
British Coal Washing Practice—By J. S. Drinkwater	337
Possibilities of Research on Non-Corrosive Metals for Handling Coal Mine Water—By W. A. Selvig	339
Mining Methods at the Pilares Mine—By V. A. Brussolo	343
Ventilation Problems at the Butte Mines of the Anaconda Copper Mining Company—By A. S. Richardson	351

DEPARTMENTS

	Page
PRACTICAL OPERATING MEN'S DEPARTMENT, COAL	330
PRACTICAL OPERATING MEN'S DEPARTMENT, METALS	343
NEWS OF THE MINING FIELD	355
WITH THE MANUFACTURERS	362

PRACTICAL OPERATING MEN'S DEPARTMENT

COAL

Mechanical Loading with Shaking Conveyors in Southern Wyoming

New Operation of the Great Valley Anthracite Corporation

British Coal Washing Practice

Possibilities of Research on Non-Corrosive Metals for Handling Coal Mine Water

METALS

Mining Methods at the Pilares Mine

Ventilation Problems at the Butte Mines of the Anaconda Copper Mining Company

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E. R. COOMBES, *Editor*

GUY N. BJORGE, *Associate Editor* | NEWELL G. ALFORD, *Associate Editor*

ERNEST H. PULLMAN, *Legislative Editor* | F. E. PRIOR, *Art Editor*

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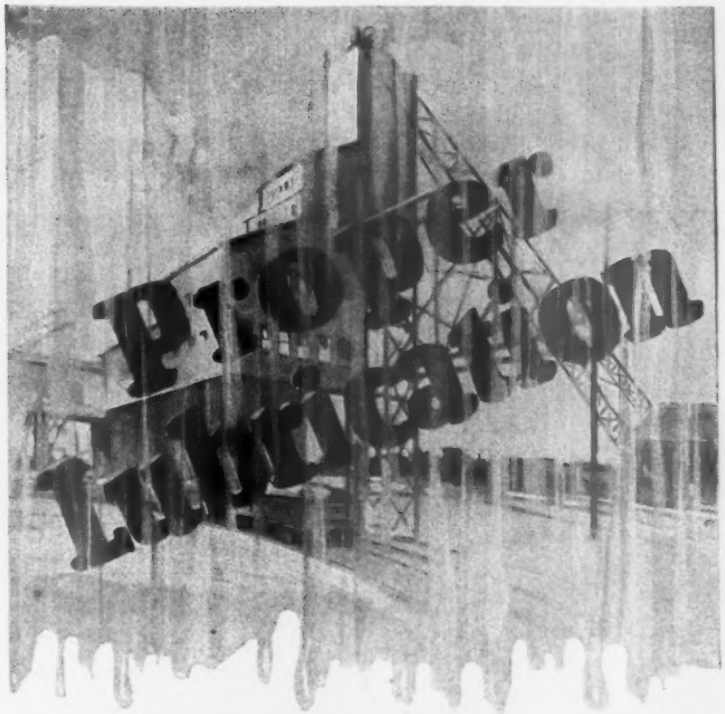

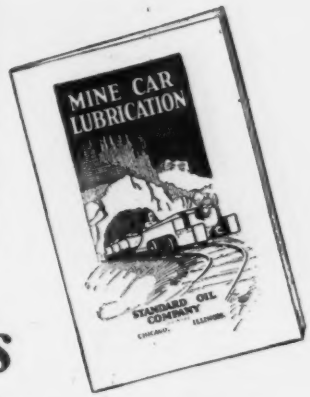

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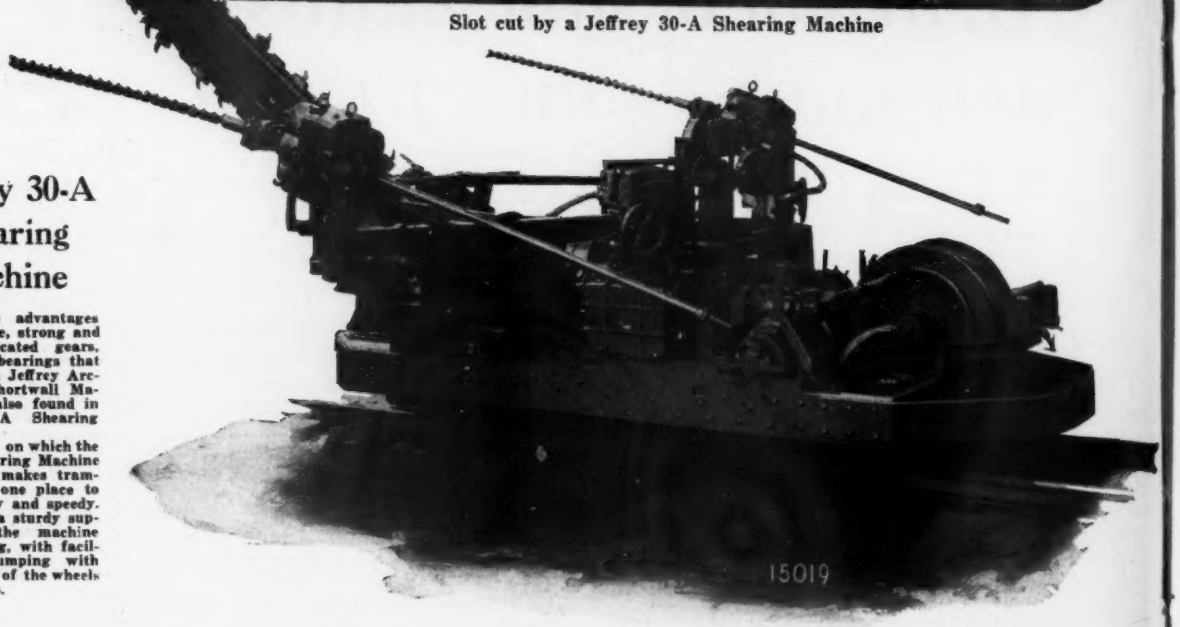
Shearing

Slot cut by a Jeffrey 30-A Shearing Machine



Jeffrey 30-A Shearing Machine

The same advantages of few, large, strong and easily lubricated gears, shafts and bearings that are found in Jeffrey Arcwall and Shortwall Machines are also found in Jeffrey 30-A Shearing Machines.

The truck on which the Jeffrey Shearing Machine is mounted makes tramming from one place to another easy and speedy. It provides a sturdy support for the machine when cutting, with facilities for sumping with the traction of the wheels on the rails.

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Sales and Service Stations: Birmingham, 26 South 20th St. Winchester, Ky., 122 N. Main St. Salt Lake City, 153 W. Second South St.

JEFFREY

Protects the Roof and Makes Loading Easy

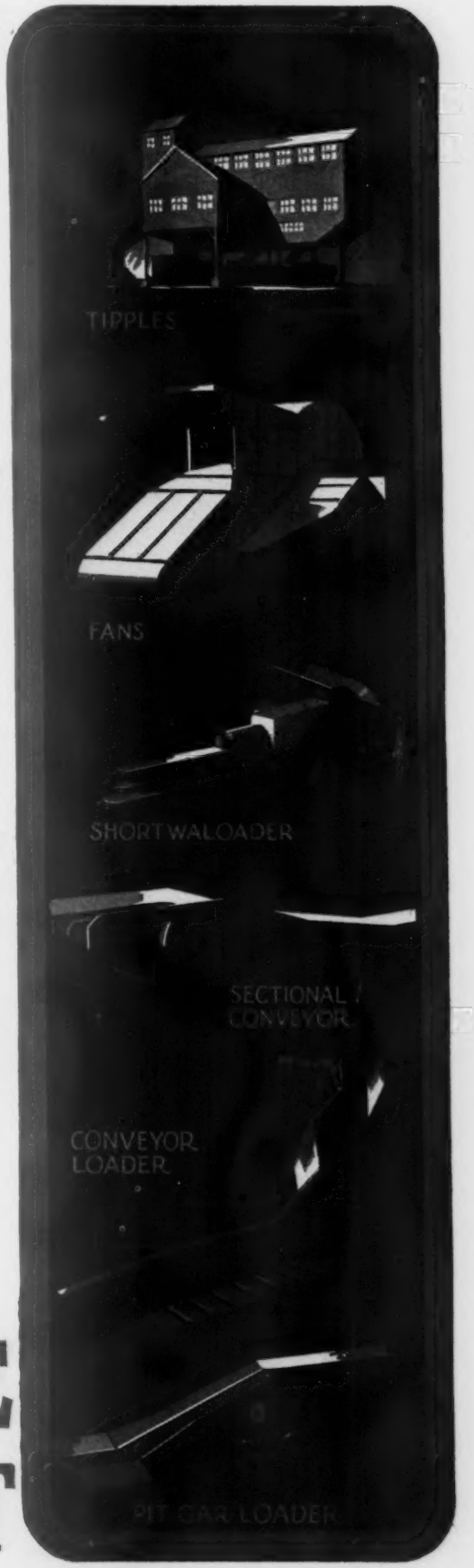
SHOOTING against the roof in this seam would probably bring the roof down; but by making a vertical cut with a Jeffrey Shearing Machine in addition to the undercut, the force of the shot is directed away from the tender roof.

Shooting coal against the free end causes the coal to break away from the roof more easily so that little time is spent pulling it down with a pick. Loading is made quicker and easier whether it be by machine or hand method, and the percentage of lump coal six inches and over is substantially increased.

A further saving of time and labor is made with a pair of drills mounted on either side of the cutter bar and supported on adjustable brackets so that shot holes can be drilled anywhere in the face of the coal at the same time the shearing machine is making the vertical cut.

The cutter bar is also designed to decrease cutting time. It is raised and lowered through self-locking gearing and remains in any position in which it may be left; no clamping and releasing of the cutter bar is necessary to make the sumping cut. The positive vertical feed of the cutter bar insures cutting at a uniform predetermined speed, not influenced by the hardness of the coal and the action of gravity.

We will be glad to send you complete data on request.



The Jeffrey Manufacturing Company

958-99 North Fourth St., Columbus, Ohio

Denver Charleston, W. Va. Salt Lake City Montreal, Canada
Pittsburgh, 600 Second Ave. Scranton, 122 Adams Ave. Terre Haute, Ind., 319 Cherry St.

COAL MINE EQUIPMENT

If Machine Runners Their Own

A Jeffrey 35-BB Shortwall at the Red Jacket Coal Company's No. 5 mine. This Shortwall, the 35-BB, is driven by a 50-hp. motor. The 35-B is driven by a 35-hp. motor.

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JEFFREY

Had to Buy Shortwalls

If machine runners chose their own shortwalls, the more experienced among them would stick to the Jeffrey.

There are several sound reasons for this Jeffrey preference among the men who do the actual cutting at the face.

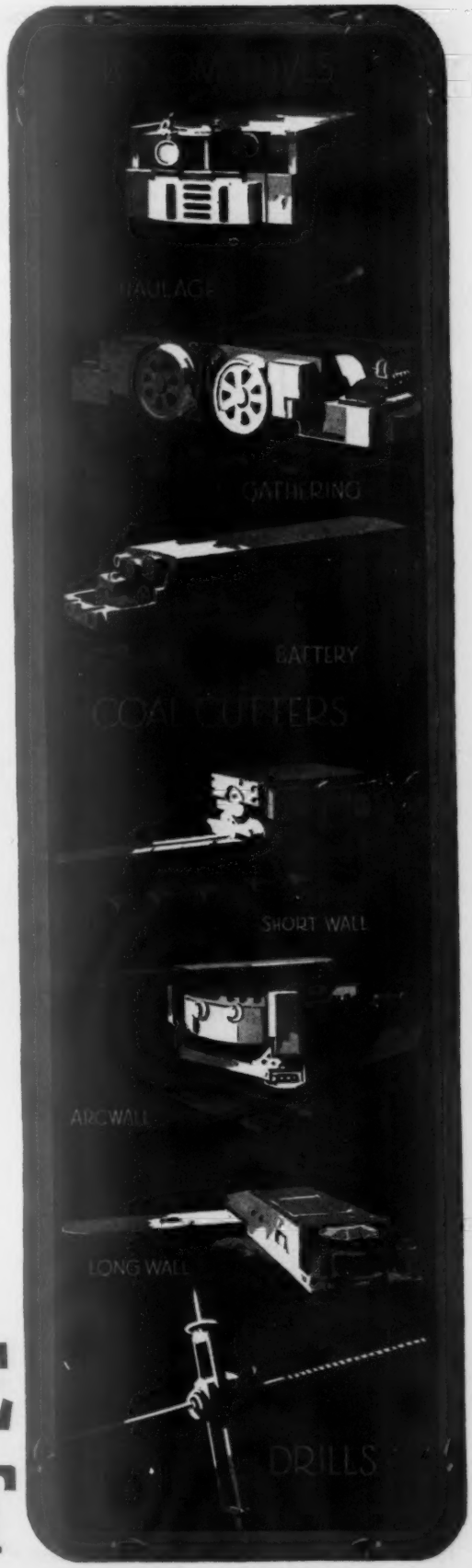
In the first place, the Jeffrey 35-B is only five feet and two inches long. This allows a maximum of clearance at the back of the machine which is very desirable in close timbering.

The ropes for handling the 35-B are self-contained on the machine. Two such power-driven ropes will make the sumping cut and the cut across the face with one setting of the jacks. No extra equipment is required.

As both drums are alive at the same time they make an extremely flexible control. The front end of the machine can be pulled forward while the rear end is being pulled backward.

Jeffrey Shortwalls are furnished to cut twenty-five inches per minute in average coal. A special slow feed allows them to cut hard coal easily. The machine will cut any material that can be cut by bits.

Aside from the question of performance, every mine electrician and repair shop foreman should know that the Jeffrey Shortwall has fewer gears than any other shortwall made. This means larger wearing parts, fewer and simpler replacements, greater accessibility and a more direct application of power, saving both power and motor windings. Write for Bulletin No. 414-A.



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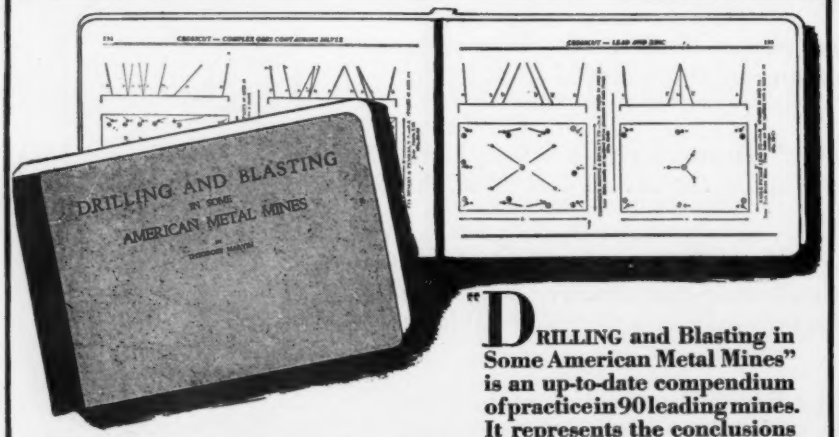
COAL MINE EQUIPMENT

The Last Word on Drilling and Blasting Practice



"DRILLING and Blasting in Some American Metal Mines" is an up-to-date compendium of practice in 90 leading mines. It represents the conclusions of hundreds of the country's foremost mining engineers, so arranged and tabulated that it furnishes a quick and simple means of reference. With this book you can find out instantly how others are solving the problems that are vexing you.

In the fore-part of the book information is given for each mine under the following headings: Company; Location; Important Mineral; Mine Entrance; Type of Ore Body; Dip and Strike; Stoping Method; Type of Ore or Rock; Manner of Breaking; Section Dimensions; Size of Holes; Type of Explosive; Cartridge Size; Detonator; How Detonated; Position of Detonator; Stemming; Holes Blasted By Whom; When Blasted; Depth of Cut; Handling Misfires; and Method of Loading.

The next section of the book contains drilling and blasting diagrams showing hole positions, order of detonation, and charges. The third section contains brief indexes which make more available the information in tables and diagrams.

The growing realization, among mining men, of the necessity for lower production costs, makes this book of especial interest at this time. It was first presented at the meeting of the American Institute of Mining and Metallurgical Engineers, February 22nd, 1928, in New York City. It is now available and will be mailed on request without charge. Please use the coupon below.

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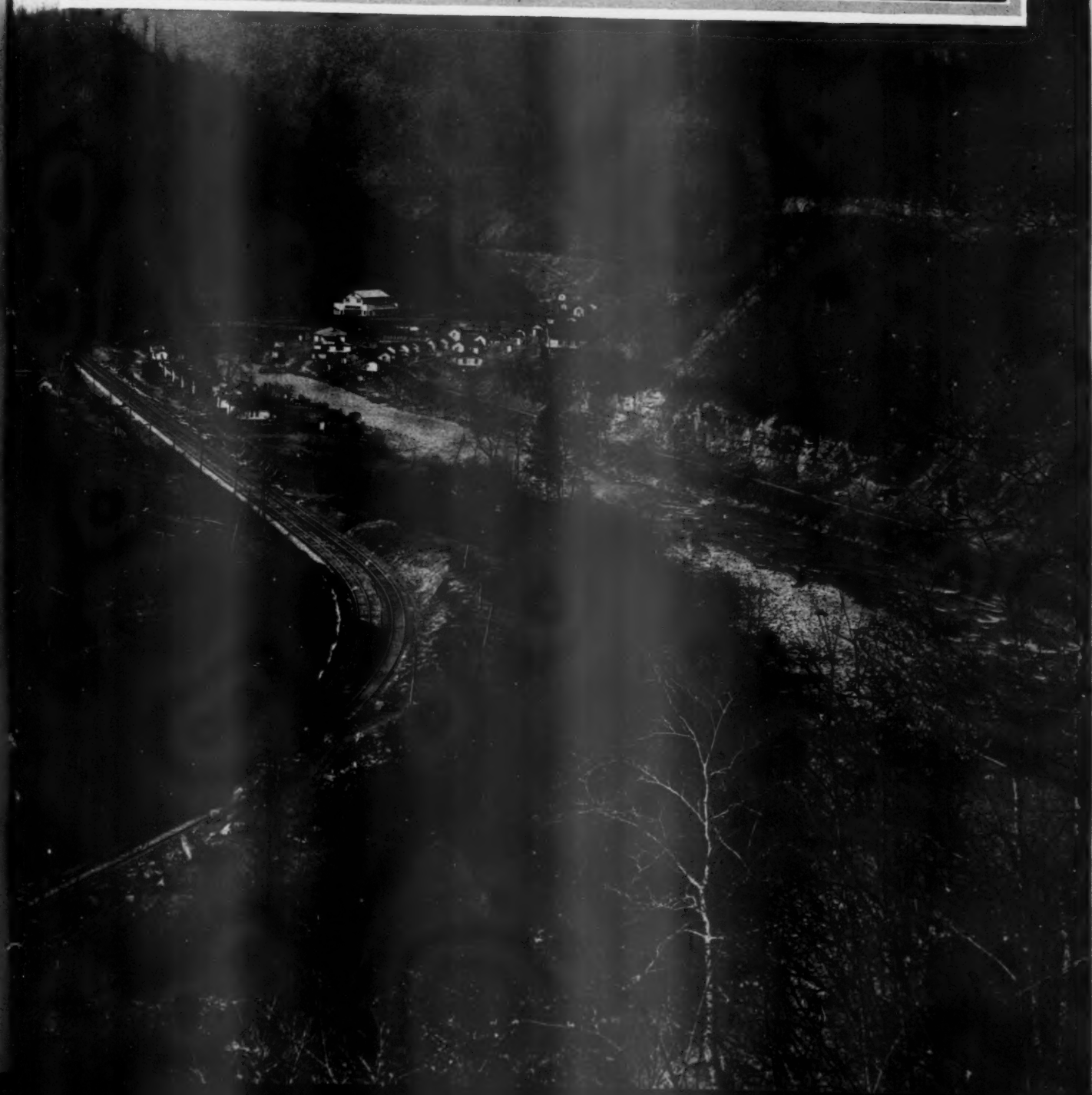

CONTENTS
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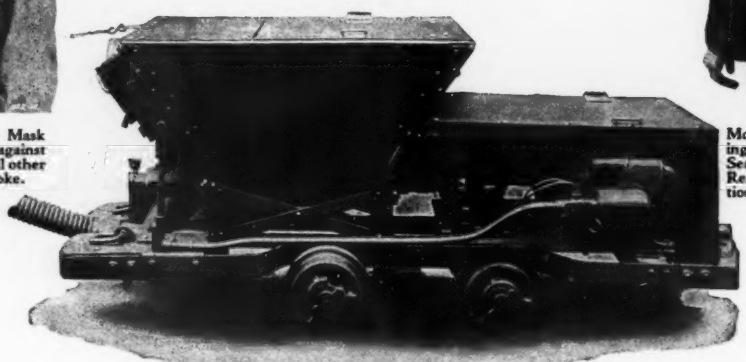

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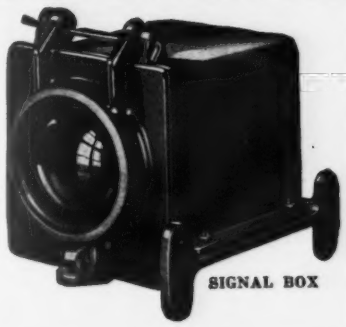
Red warns him that some other trip has the right of way. Green, proceed in safety. An Automatic Signal System installed on the haulway will protect trips from collision —permit them to proceed in safety with the least loss of time—removes hand flagging and telephoning from your transportation problem. Ask us how we can help YOU.



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CANTON AUTOMATIC MINE DOORS

Opens automatically when approaching trip is 25 feet from the door. Closes automatically when last car of trip is 35 feet beyond the door. Many run-a-way trips have safely passed through these doors. Ventilation of mine is interrupted only momentarily. Reversing the air has no effect on the door. Circulation sufficient to remove gases from the mine is secured where Canton Automatic Doors are installed.

MORE AIR AT THE FACE IS WHY WORKMEN LIKE THEM

SURE TO OPEN

NO TRIP TOO FAST
NO LOST AIR

At 50 cents a day it does better work than trappers from $2.00 to $7.00 per day.

A DOOR IN TIME MAY SAVE YOUR MINE

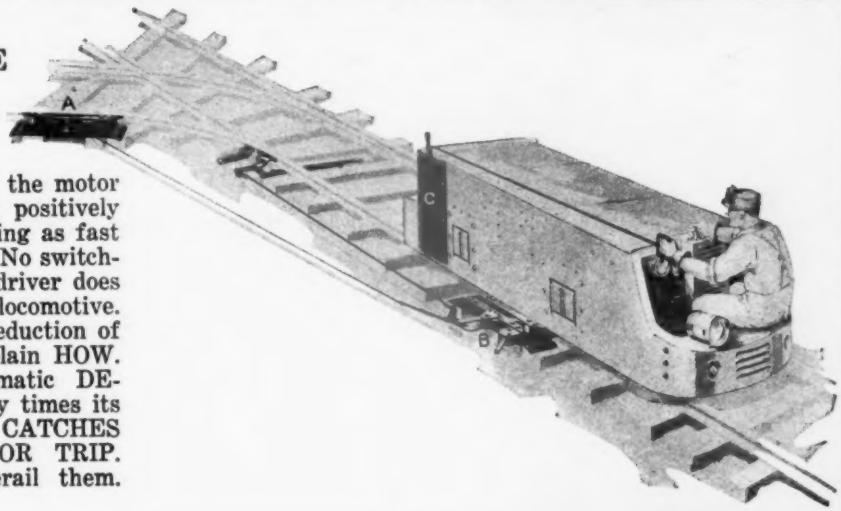
OVER 5,000 IN USE
CAN BE LEASED OR PURCHASED

WRITE US TODAY

SURE TO CLOSE

CANTON AUTOMATIC SWITCH THROWERS

SAVES LIVES
SPEEDS HAULAGE
SAVES MONEY



Latches are thrown by the motor driver accurately and positively while the trip is traveling as fast as it can hold to rails. No switchman required. Motor driver does not leave his seat on locomotive. Saves its cost in the reduction of power. Ask us to explain HOW. Installed as an automatic DERAIL it will save many times its cost every time IT CATCHES RUN-A-WAY CARS OR TRIP. It does catch and derail them. Ask us HOW.

AMERICAN MINE DOOR COMPANY
2663 Dueber Ave. ~ Canton, Ohio

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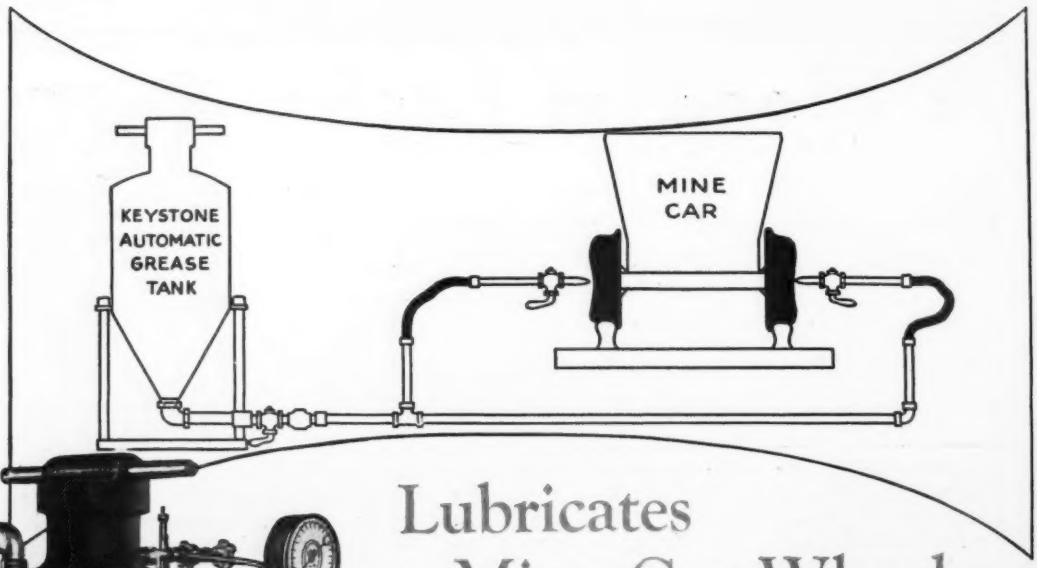
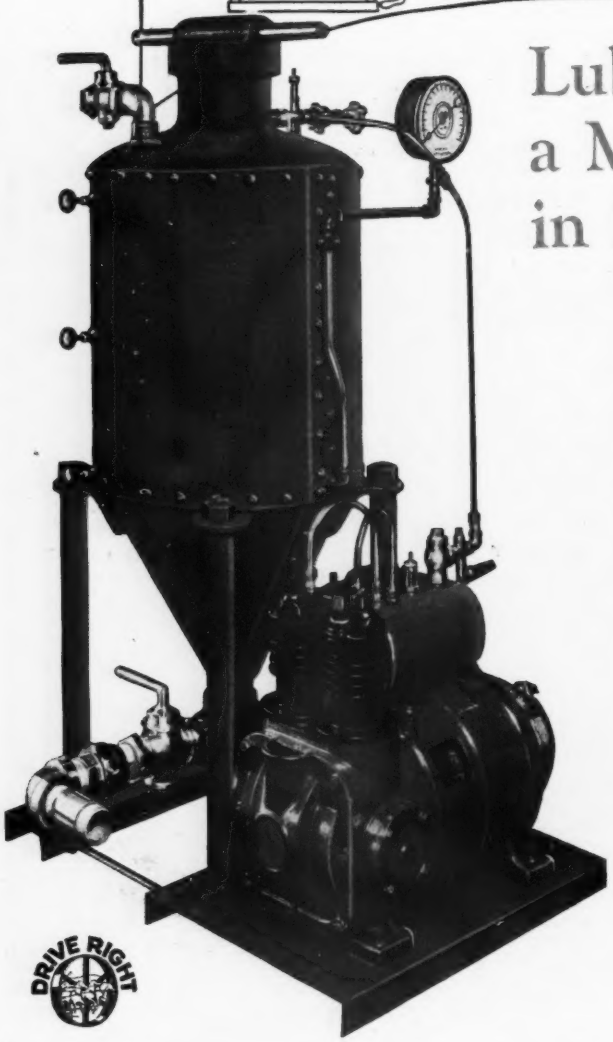




Lubricates a Mine Car Wheel in 15 Seconds

THIS is the remarkable service being rendered by the Keystone Pneumatic Safety Lubricator in mines where it has been installed.

The operator simply pushes the hose nozzle into the car wheel plug, turns the valve lever —and in a jiffy the wheel is lubricated.

The great saving in labor cost is obvious. In mines where it is already installed the Keystone Pneumatic Lubricator, plus Keystone Grease, is effecting economies even beyond expectation. It can do the same for you.

Specially designed Keystone nozzles make this system adaptable for use with practically every kind of mine car wheel plug.

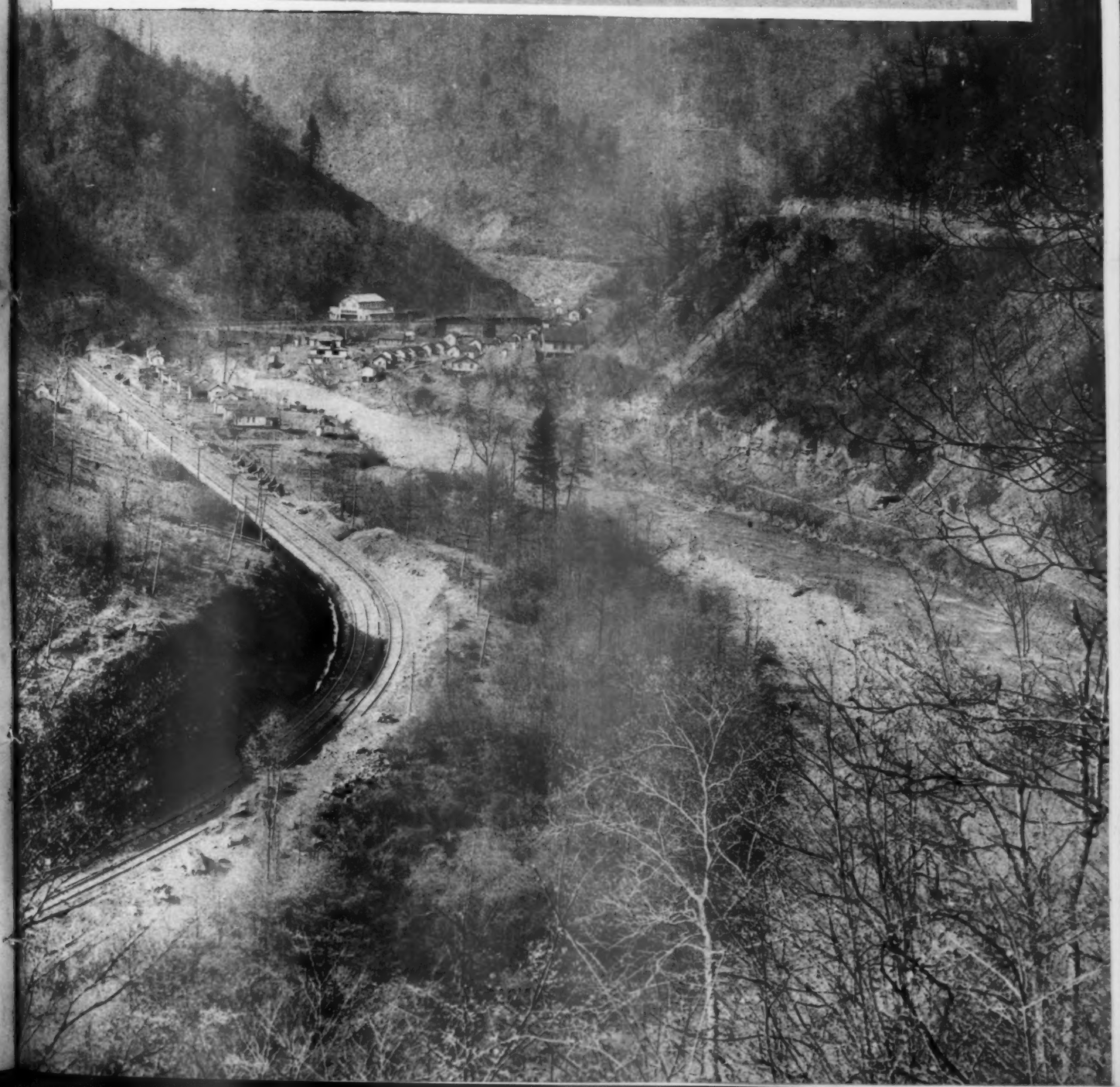
Let use prove to you on your own cars that this system can save you money, time and trouble—and pay for itself in a short time.

KEYSTONE LUBRICATING COMPANY
Established 1884
21st, Clearfield & Lippincott Streets, Philadelphia, Pa.

KEYSTONE
TRADE MARK
REG. U.S. PAT. OFF.
GREASE

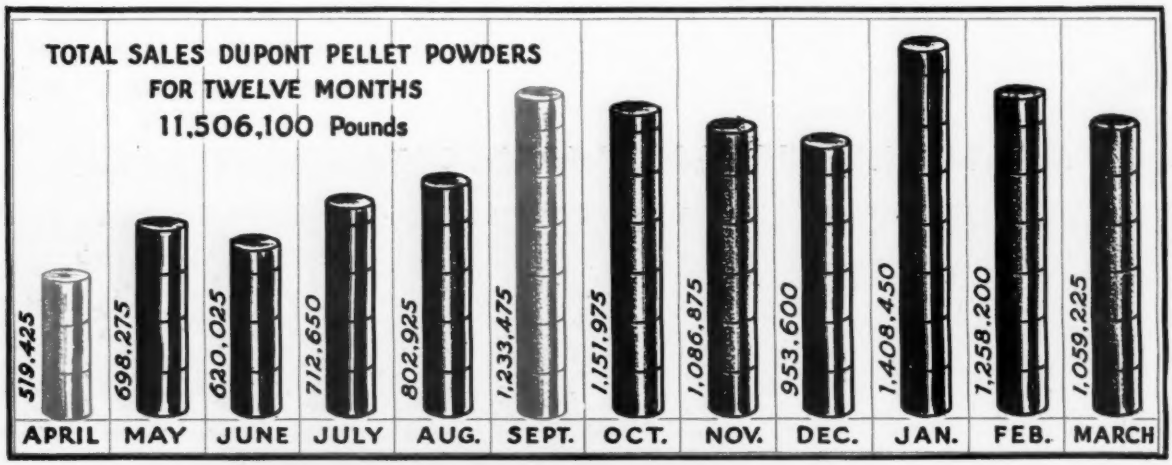
KEYSTONE
PNEUMATIC SAFETY LUBRICATOR

DRILLING & BLASTING



Du Pont Pellet Powder Sales

SALES CHART FOR PELLET POWDER



If you are to be at the National Exposition of Coal Mine Equipment at Cincinnati, May 7th to 11th, see our Pellet Powder Display located in Booths 245 and 247 on Second Floor of Music Hall.

DUPONT

REG. U.S. PAT. OFF.

Doubled in FIVE Months!

FROM a little over five hundred thousand pounds to considerably over a million pounds is a big jump in sales for a new powder, but a still bigger jump for an entirely new type of explosive. More than half a million pounds (519,425) of du Pont Pellet Powder were sold in April last year, but just five months later, September sales leapt to 1,233,475 pounds —more than a 100% increase. By the end of March, 1928, sales reached the staggering total of 11,508,100 pounds of du Pont Pellet Powder.

These are pounds of explosives—not cigarettes, cigars or candy. Du Pont Pellet Powder had to prove itself to mining engineers, superintendents and miners. Actual performance, not personal prejudice, sold du Pont Pellet Powder.

Certified Performance

These performances of du Pont Pellet Powder are certified by engineers of the A. C. Nielsen Company who surveyed various mines in the Pittsburgh District. In the mine of the West Virginia-Pittsburgh Coal Company, du Pont Pellet Powder reduced slack 3%, resulting in a saving of $3,276 a year. In the Pittsburgh Coal Company's non-gaseous mines in the Pittsburgh bed, slack was decreased from 33 to 30.5%, saving $8,400 a year. Tons per pound of explosives were increased from 6 to 11, reducing powder cost to the miner 38.6%. Production in the Reed-Rudolph Coal Company's mines was increased 5% and $720 a year saved on overhead costs by the use of Pellet Powder. Their customers, too, were better satisfied with the finer quality of coal produced with Pellet Powder.

Greater Efficiency—Greater Safety

All of these mines found that Pellet Powder saved time in making cartridges, in ramming, in prompt resumption of work; that safety was greatly improved by reducing handling, better control of supplies, less jarring of roof, less smoke; and that Pellet Powder was more efficient because shots were more accurately gauged, less powder was used per ton, cartridges were of uniform size, and consequently there was less shattering due to overshooting.

Pellet Powder is more than just a new explosive: it is a new means of reducing overhead, improving quality of coal, and bettering safety conditions. As such, du Pont Pellet Powder merits your careful consideration. Let a du Pont representative tell you the whole story of Pellet Powder's advantages. In the meantime, send for copies of Nielsen Certified Performance Surveys that tell from an impartial engineer's viewpoint the advantages of du Pont Pellet Powder. Write today.

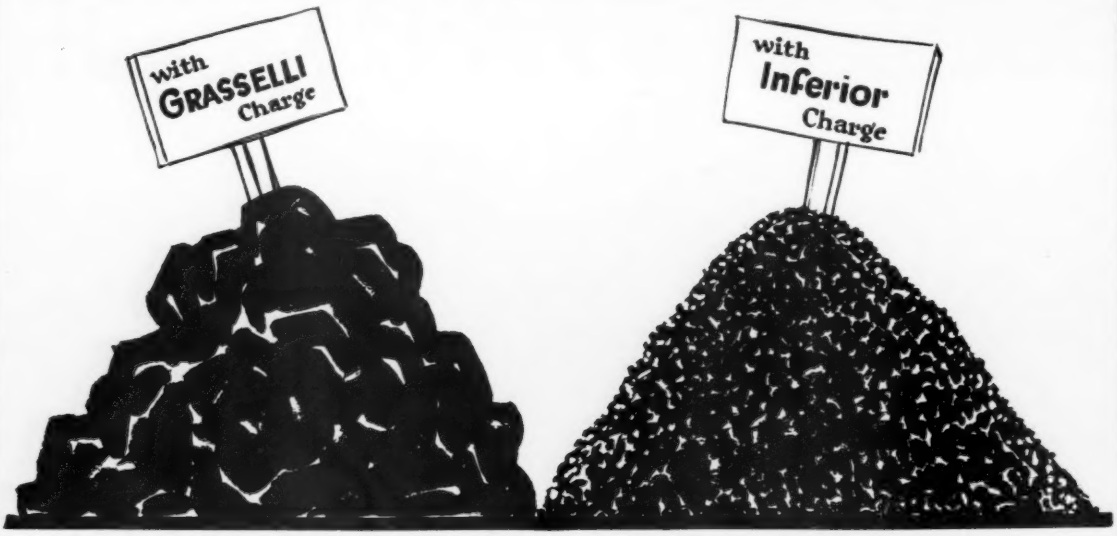
E. I. DU PONT DE NEMOURS & CO., INC.

Explosives Department

WILMINGTON, DELAWARE

DU PONT

REG. U. S. PAT. OFF.



At the National Exposition of Coal Mine Equipment

THE Grasselli Powder Company through years of research have produced explosives best suited to meet the requirements of the mining field. Call at Booth 276 and discuss your problems with a Grasselli representative.

Maintaining twelve branch offices and over 50 warehouses the Grasselli Powder Company can assure you of prompt delivery.

A representative from our nearest branch will gladly give you information as to just the right Grasselli explosive to satisfy your conditions.

To meet the increased demand for Grasselli explosives a new Grasselli high explosive plant is under construction in Seneca, Illinois. The three plants now operating are located in New Castle, Pa., Quaker Falls, Pa., and Wyside, Pa.

Call and see us at Booth 276

THE GRASSELLI POWDER COMPANY

Main Office: Cleveland, Ohio

BRANCHES:

BIRMINGHAM, ALA.
BLUEFIELD, W. VA.
CHICAGO, ILL.
DULUTH, MINN.
KANSAS CITY, MO.
MIAMI, FLA.

ESTABLISHED 1839
CHEMICALS
GRASSELLI
ZINC
EXPLOSIVES

PHILADELPHIA, PA.
PITTSBURGH, PA.
POTTSVILLE, PA.
ST. LOUIS, MO.
EASTON, PA.
WILKES-BARRE, PA.

GRASSELLI EXPLOSIVES

TO OPERATORS NOW USING BLACK BLASTING OR PELLET POWDER

HERCOAL-F is rapidly replacing Blasting and Pellet Powder. It is the same in strength and lower in cost for equal volume.

It is a Permissible, less inflammable than Blasting or Pellet Powder, safer to handle, and its fumes are much better.

HERCOAL-F is packed in cartridges, which adds to the convenience as well as to the safety of handling. It runs about 500 (1¼" x 8") cartridges per 100 lbs., as against about 184 cartridges of the same size for Pellet Powder.

There is no similar explosive on the market. HERCOAL-F is an entirely new explosive, representing a distinct improvement over all other explosives for the purpose for which it was designed—to shoot coal that heretofore could be produced satisfactorily and economically only with Black or Pellet Powder.

Write for booklet and prices.

HERCULES POWDER COMPANY
(INCORPORATED)

Sales Offices: Allentown, Pa., Birmingham, Buffalo, Chattanooga, Chicago, Denver, Duluth, Hazleton, Pa., Huntington, W.Va., Joplin, Mo., Los Angeles, Louisville, New York City, Norristown, Pa., Pittsburg, Kan., Pittsburgh, Pottsville, Pa., St. Louis, Salt Lake City, San Francisco, Wilkes-Barre, Wilmington, Del.

Hercules Powder Company, Inc.,
934 King Street, Wilmington, Delaware
Please send me booklet describing Hercoal-F.

Name .....

Company .....

Street ..... City ..... State .....

HERCOAL-F

COUNT:
About 500 cartridges (1¼"x8") per 100 lbs.

COMPARED WITH BLASTING OR PELLET POWDER:

STRENGTH
—the same

FUMES
—much better

COST
—no more

SAFER
—Hercoal-F is a permissible explosive

1431

Coal-Sulphur-Clay-Slate

-all the same to the "JACKHAMER!"

The "Jackhamer" Drill accounts for approximately 120,000,000 tons of coal a year. It also does most of the work preliminary to the actual taking out of the coal. Such work as shaft sinking, driving of crosscuts and gangways, stripping, trimming, ditching, cutting trolley hanger holes and numerous other jobs are essentially "Jackhamer" jobs.

The "Jackhamer" is the ideal drill for working in rooms, narrow veins, in close quarters, etc. It is light in weight and easy to handle, yet it is powerful, durable, and economical.

There is a correct size I-R "Jackhamer" for each coal and rock problem.

INGERSOLL-RAND COMPANY

11 Broadway New York City

Offices in Principal Cities the World Over

For Canada Refer—Canadian Ingersoll-Rand Co., Limited
10 Phillips Square, Montreal, Quebec

Let us tell you about the I-R Radialaxe Coal Cutter. It lowers mining costs and improves the quality of the output. "Horsebacks" and "niggerheads" do not stop the Radialaxe.

Ingersoll-Rand

327-J. D.

CUTTING LOADING & CONVEYING

Sullivan Coal Loader at work, Francisco Mine, Princeton, Ind.

SULLIVAN CONTRIBUTIONS TO

A New Coal Loader

This new Sullivan Loader has been successfully used in actual work for more than two years. It combines these advantages.

1—Compactness—(5 ft. 4 in. wide.)
2—Loads undercut coal, without special preparation.
3—Maximum capacity in prepared coal.
4—Continuous delivery of coal to conveyor.
5—Raking roller bit bar digs standing coal as well as loose.
6—Caterpillar traction mounting.
7—Independent control of each digging, conveying, and moving member.
8—Good for any coal 5 ft. or more high.
9—Adapted for longwall as well as room mining.

Ask for Bulletin 3786-A

AT CIN

Booths 67, 110, 112, 114,

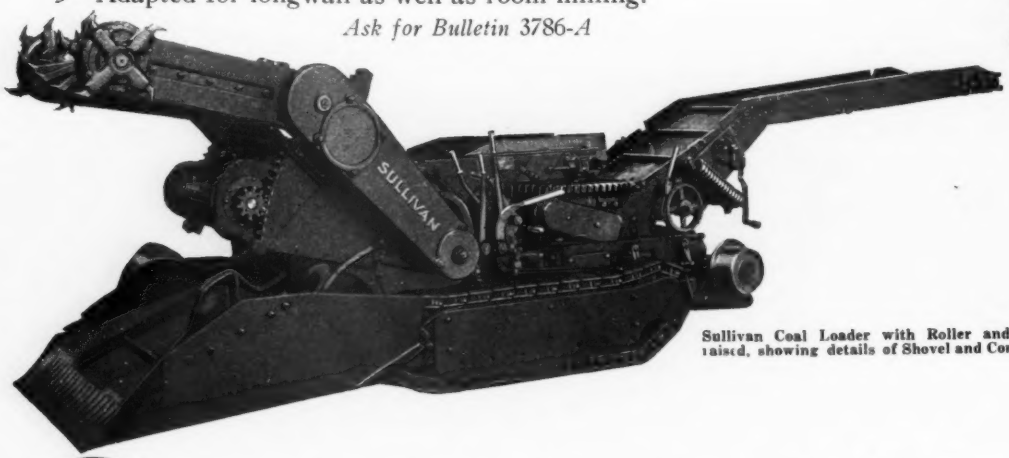
Look for

See the:

New Sullivan Coal Loader

New Sullivan Track Cutter

New Sullivan Longwall Cutter



Sullivan Coal Loader with Roller and Arms raised, showing details of Shovel and Conveyors

SULLIVAN Trade Mark

Boston New York Huntington Pittsburgh St. Louis Knoxville Birmingham

SULLIVAN MACHINERY COMPANY
148 SOUTH MICHIGAN AVE., CHICAGO

Terre Haute Muskogee Duluth Spokane Denver El Paso Salt Lake City

"CLU" Drilling the coal after undercutting. Columbia Steel Corporation, Utah

COAL MINE MECHANIZATION

A New Track Cutter

CINNATI

69, 71, 73, 75, 116, 118.

Sullivan exhibit.

New Sullivan Scraper Hoist

All machines under power—

Watch them operate!

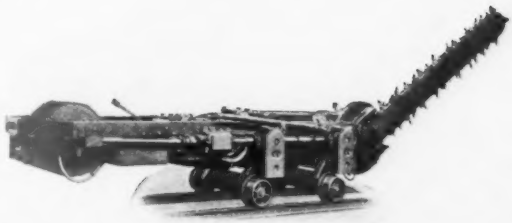
CLU Has These Advantages

CLU undercuts
CLU overcuts
CLU shears
CLU adjusts for height
CLU drills slate and coal
CLU draws pillars
CLU cuts entries or room to 25 feet
CLU is self-propelling
CLU is handled by two men
CLU is the latest, most versatile coal cutter

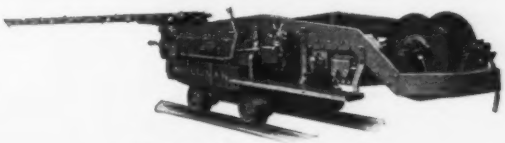
See it in operation at:

The American Mining Congress

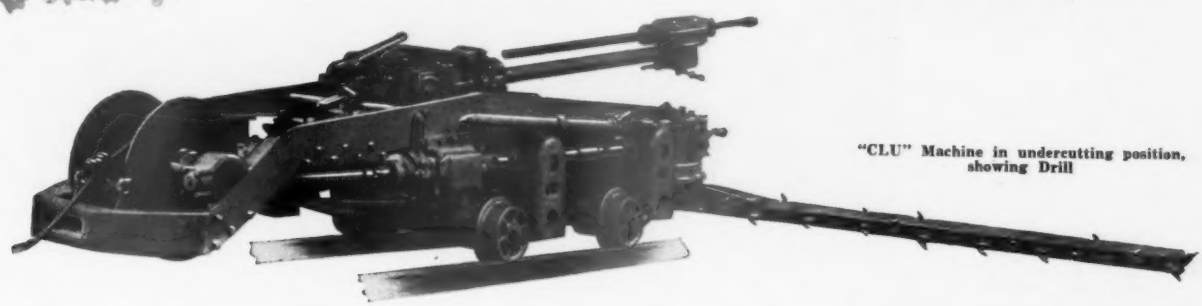
ASK FOR BULLETIN 3782-E



"CLU" in Shearing Position



"CLU" in Center Cutting Position



"CLU" Machine in undercutting position, showing Drill

SULLIVAN Trade Mark

Vancouver Drumheller London Paris Katowice Sydney Calcutta Tokyo

Only at the loading boom does the top require brushing.

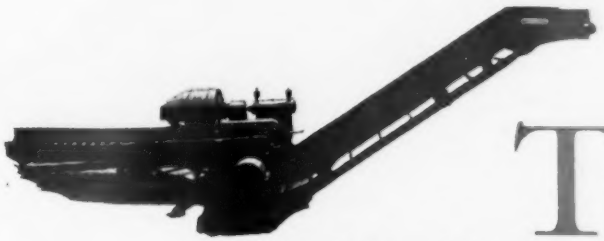
For

The loading boom travels 20 feet per minute faster than the main conveyor, thus avoiding congestion.

Steel and Composite Mine Cars. Sectional Conveyors. Portable Belt Face Conveyors. Cast Steel and Cast Iron Mine Post Jacks. Track Work of all kinds.

The LORAIN

rapid development under difficult mining conditions



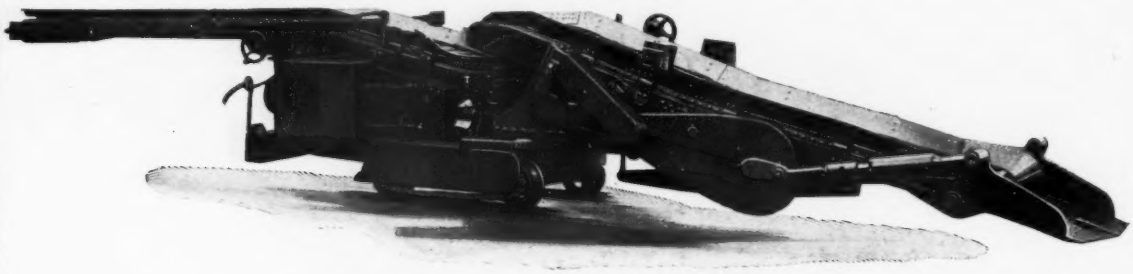
THESE pictures of the loading boom and driving end of the Lorain Sectional Conveyor give a good idea of its unusual fitness for low vein mining. The conveyor troughs stand 13 inches high and the low height eliminates the necessity for top brushing in low coal except at the loading boom to allow the coal to be loaded on the mine cars. The conveyor is reversible, easily handled and equipped with many safety and time and space saving features. Where rapid development is imperative its economies are specially apparent. See it at the Cincinnati Exposition and let us give you complete details or write for further information.

We build all types of mine cars—steel and composite. They are sturdy and easy rolling. This car is equipped with Timken bearings.

Johnstown, Penna.

STEEL Co.

The Whaley Single Motion Shovel



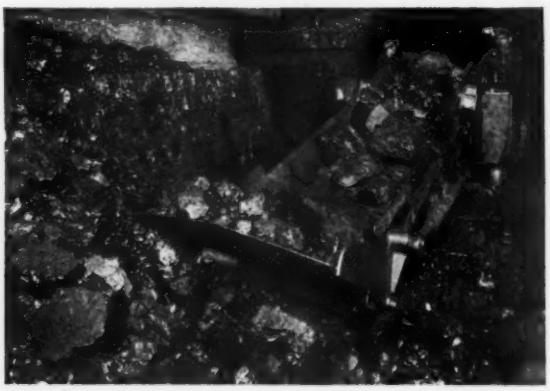
WSM 4 Shovel—Right Hand Side—Left Hand Control

This New Machine For Coal Loading Will Be on Exhibit Booths 22, 24, 26, 28—The Cincinnati Exposition—May 7-11

The Whaley Single Motion Shovel, with a capacity well in excess of a ton per minute of shoveling time, is a proved machine, two of them in double shift operation for the past twenty months, have shown the following outstanding advantages for Coal Loading.

1—Smooth, easy loading movement—no "batting around" or degradation of coal.

2—Cleans up—no hand shoveling required to leave place in good shape for cutting machine.



3—Wide reach—cleans up 24 ft. wide from one track. Moves under its own power to next place without delay for adjustments.

4—No dust is raised by this machine—a decided advantage, especially in dusty and gaseous mines.

5—Where coal is thin and top rock is "brushed" the low front end enables the machine to reach under and load the coal first, then load the rock.

(Permissible Equipment if Required---U. S. Bureau of Mines Approval Nos. 127-127A)

When Writing For Information Please Mention Your Conditions

MYERS-WHALEY COMPANY, Inc.

Knoxville, Tennessee, U. S. A.

Fore-shadowing a Good Production Record

See the latest type Kangaroo Konveyor Drive on display at our Booths 41-43-45 at the National Exposition of Coal Mine Equipment, Cincinnati, Ohio, May 7-11.

Every mine official who is interested in making a good production record at a low cost in a concentrated area should have a copy of the Link-Belt Catalog on Underground Conveyors and Mine Car Loaders.

It is sure to stimulate your ideas on the possibilities underground conveying offers in your mine.

In writing our nearest office ask for a copy of Book. No. 921.

3398

LINK-BELT COMPANY

Leading Manufacturers of Elevating, Conveying, and Power Transmission Machinery and Chains

PHILADELPHIA, 2045 Hunting Park Ave.
Pittsburgh - - - - - - - 335 Fifth Ave.
St. Louis - - - - - - - 3638 Olive St.

CHICAGO, 300 W. Pershing Road
Wilkes-Barre - 826 2nd National Bank Bldg.
Huntington, W. Va. - Robson-Prichard Bldg.

INDIANAPOLIS, 200 S. Belmont Ave.
Denver - - - - - - - 520 Boston Bldg.
Birmingham, Ala. - 229 Brown-Marx Bldg.

LINK-BELT
Underground Conveyors

COLODERS ARE DEPENDABLE

The first modern COLODER—installed in 1918 is delivering full tonnage every working day.

THE COLODER COMPANY, Inc.

568 North Fourth St.
Columbus, Ohio
U. S. A.

increasing! tonnage per year

See Our Exhibit in Booths 31 33 35 IN CINCINNATI

EDWARD BOTTOMLEY
GENERAL SUPERINTENDENT

SHERIDAN-WYOMING COAL COMPANY
INCORPORATED

HARRY N. TAYLOR
PRESIDENT

Kleenburn, Wyoming
March 19, 1928

Joy Manufacturing Company
Franklin, Pennsylvania

Gentlemen:

For your information we are tabulating a record of the number of shifts worked and tonnage produced for the year 1927 as compared with the year 1926 at our Acme mine.

You will note that though the same number of days were worked in each year working shifts increased, and the production per machine shift shows an increase from 197 tons in 1926 to 233 tons in 1927.

The four Joys are working entirely on development.

1926	Days Worked	Joy Tonnage Output
January	17	12,600.50
February	14	9,813.35
March	14	9,924.10
April	12	8,605.25
May	14	10,129.35
June	14	12,952.10
July	14	12,875.85
August	17	11,052.85
September	22	17,884.30
October	24	20,052.60
November	22	17,976.45
December	18	15,442.65
Days, Total	202	159,309.35
Shifts, Total	808	159,309.35

1927	Days Worked	Joy Tonnage Output
January	18	14,887.70
February	12	10,030.20
March	13	12,360.55
April	13	12,436.70
May	10	10,146.75
June	15	15,058.85
July	11	12,746.00
August	16	16,248.60
September	19	17,799.15
*October	26	26,283.50
*November	23	25,344.45
*December	26	31,391.80
Days, Total	202	205,766.45
Shifts, Total	863	205,766.45

* One machine double-shifted

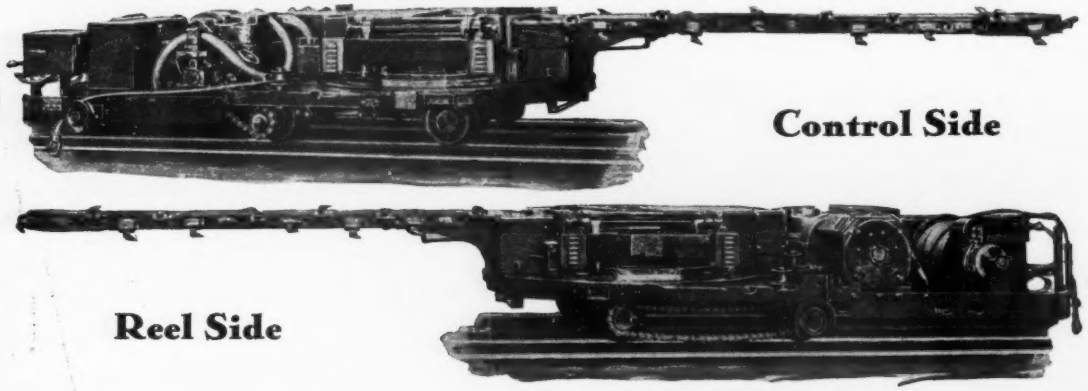
Yours very truly,

Edward Bottomley
General Superintendent

B:W

JOY MANUFACTURING COMPANY
FRANKLIN, PA.

The NEW Goodman Low-Vein Slabber!

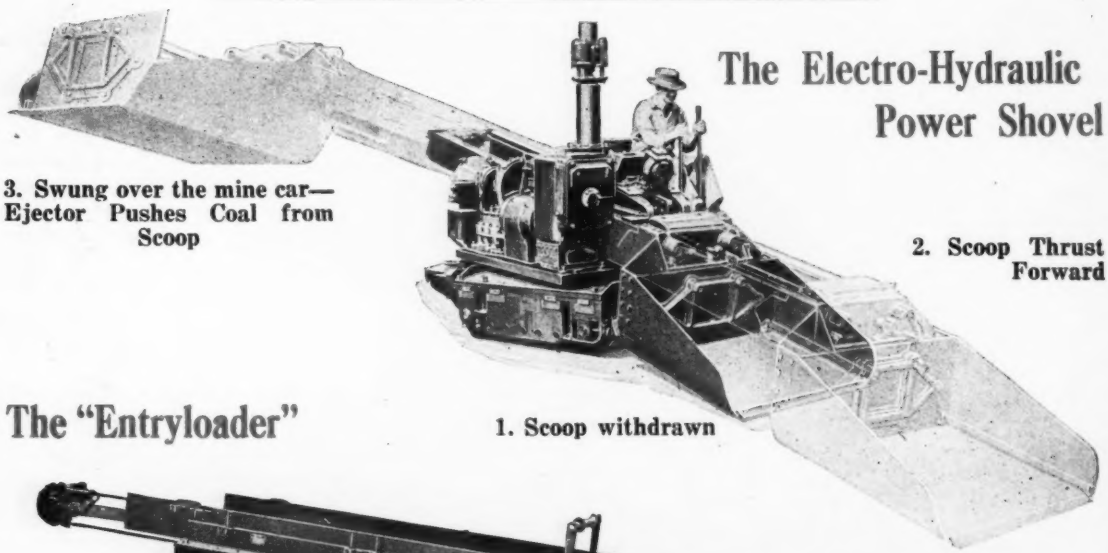


Control Side

Reel Side

Just like the Big Goodman—only Lower

See it on the floor at Cincinnati!



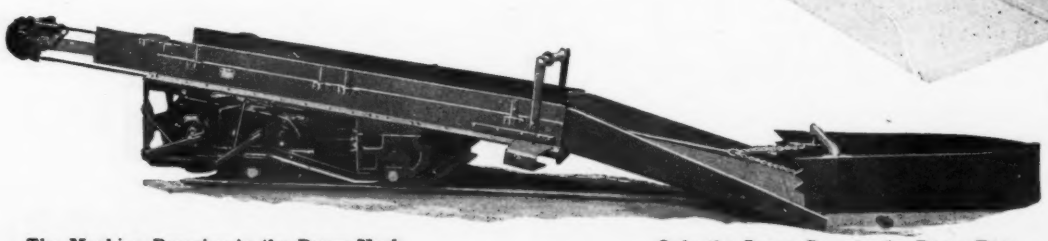
The Electro-Hydraulic Power Shovel

3. Swung over the mine car—Ejector Pushes Coal from Scoop

2. Scoop Thrust Forward

1. Scoop withdrawn

The "Entryloader"



The Machine Remains in the Room Neck

Only the Scoop Goes to the Room Face

(85)

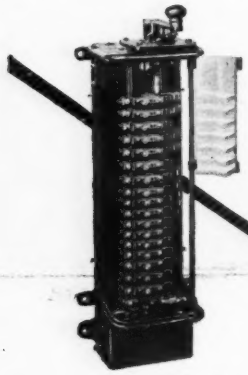
GOODMAN MANUFACTURING COMPANY
HALSTED ST. at 48TH
CHICAGO---ILL.

Locomotives - Loaders - Coal Cutters

PITTSBURGH – CHARLESTON, W.VA. – HUNTINGTON, W.VA. – CINCINNATI – BIRMINGHAM – ST. LOUIS – DENVER – PRICE, UTAH

POWER EQUIPMENT

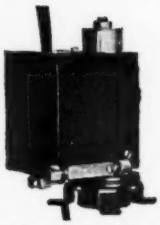
For every application



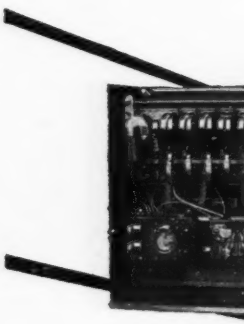
Drum switches for a-c. or d-c. motors driving cranes, hoists, machine tools compressors, etc

Magnetic switches, with thermal-overload protection, for throwing a-c motors across the line

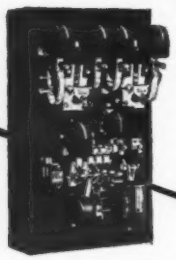
Hand-operated switches, with thermal-overload protection, for starting small a-c motors



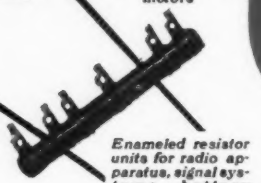
Switches for maintaining predetermined pressure or vacuum—to control small motors driving water pumps, air compressors, or vacuum pumps



Automatic compensators, with thermal overload protection and definite-time acceleration for squirrel-cage motors

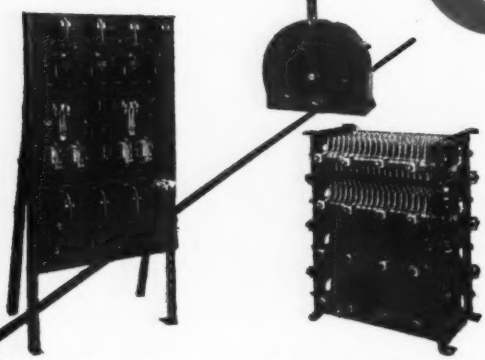


Reversing controllers, with definite-time acceleration, dynamic braking, and full-field features, for controlling d-c. adjustable-speed motors



Enameled resistor units for radio apparatus, signal systems, battery chargers, fractional horsepower motors, etc.

G—Contr



Magnetic-time controllers for d-c. mill motors used on cranes, hoists, and steel-mill auxiliaries

FROM the complete line of G-E controllers, can be selected a controller for any motor and for any application. Years of experience in the manufacture and application of millions of motors has brought a deep insight into the requisites of good motor control—a practical insight that has been translated into better controllers.

In every G-E controller you will find the most advanced engineering features—features pioneered and perfected by General Electric. Safety—built into every device. Reliable time-limit acceleration—superseding current-limit acceleration.

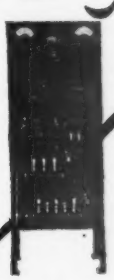
GENERAL

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

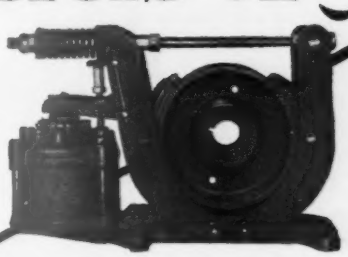
in every industry

-E-ollers

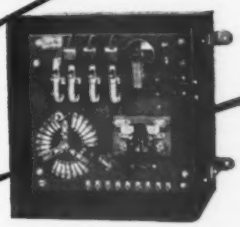
Push-button stations—available in sizes and forms for all types of magnetic controllers



Synchronous-motor starters—push-button operated—field automatically applied

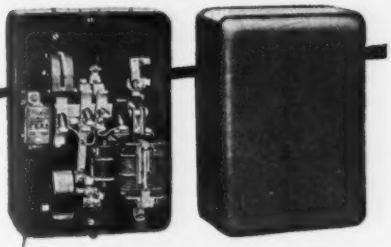


A-c. or d-c. shoe-type, spring-set solenoid brakes for floor or motor mounting—for holding loads and for quick stopping



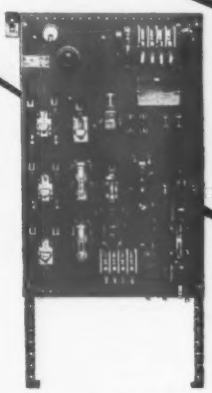
Speed-regulating, primary and secondary controllers for wound-rotor motors driving ventilating fans and blowers

Solenoids—push or pull or a combination of both—interchangeable for alternating current or direct current



Non-reversing controllers, with definite-time acceleration and dynamic braking, for controlling d-c constant-speed motors

Float switches for motor-driven pumps to maintain a predetermined water level



Magnetic controllers for d-c. elevators. Similar controllers are available for a-c. elevators

Hand-operated compensators with thermal overload protection, for starting squirrel-cage motors

Thermal-overload protective devices—characterized by extreme accuracy and dependability. Time-delay undervoltage release — necessary because of super-power systems. Beauty in shape and color—matching the improved appearance of modern machinery. And, always, smaller controllers for larger motors.

These are typical of the continual improvements that industry has learned to expect of G-E controllers. These improvements and the steadily decreasing price to the user are the results of good engineering and efficient large-scale production.

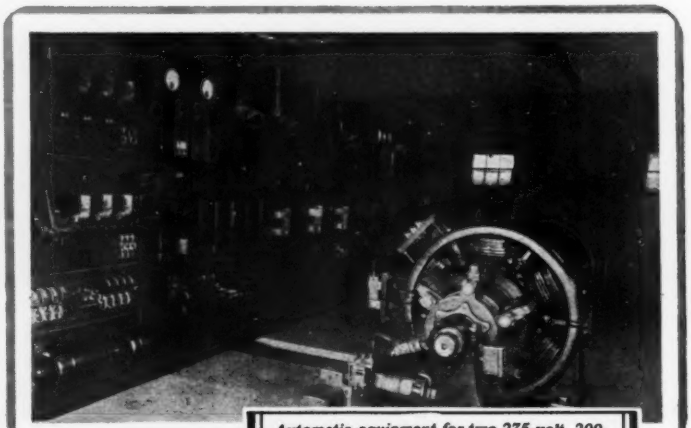
301-26

ELECTRIC

SALES OFFICES IN PRINCIPAL CITIES

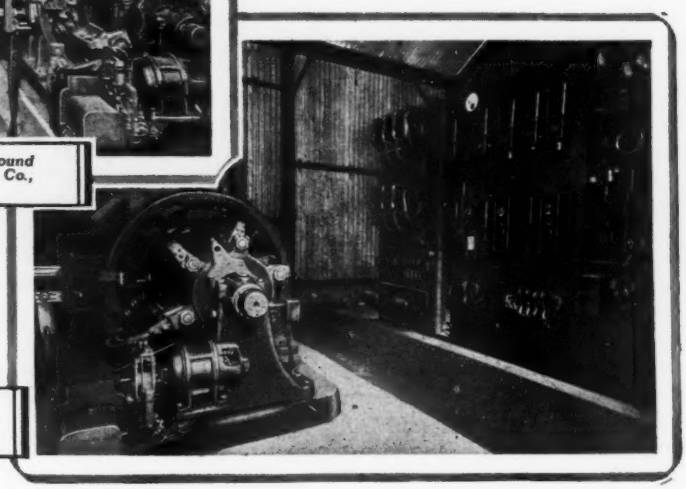
Automatic Switching Equipment

Full-automatic underground substation, Stonega Coke and Coal Co., Big Stone Gap, Va.



Automatic equipment for two 275-volt, 200-kw. converters, Benedict Coal Corp., St. Charles, Va.

Full-automatic, double-unit underground substation, Stonega Coke and Coal Co., Big Stone Gap, Va.



275-volt, 200-kw. synchronous converter and control panels, Elkhorn Coal Corp., Wayland, Ky.

GENERAL

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

Works Important Economies

These few mine installations are typical of many where G-E automatic switching equipments are working important economies. Such equipments perform automatically and in proper sequence all operations necessary to start and stop a synchronous converter or motor-generator, and at the same time afford thorough protection for the machine.

To-day, mine after mine is turning to automatic switching equipment because:

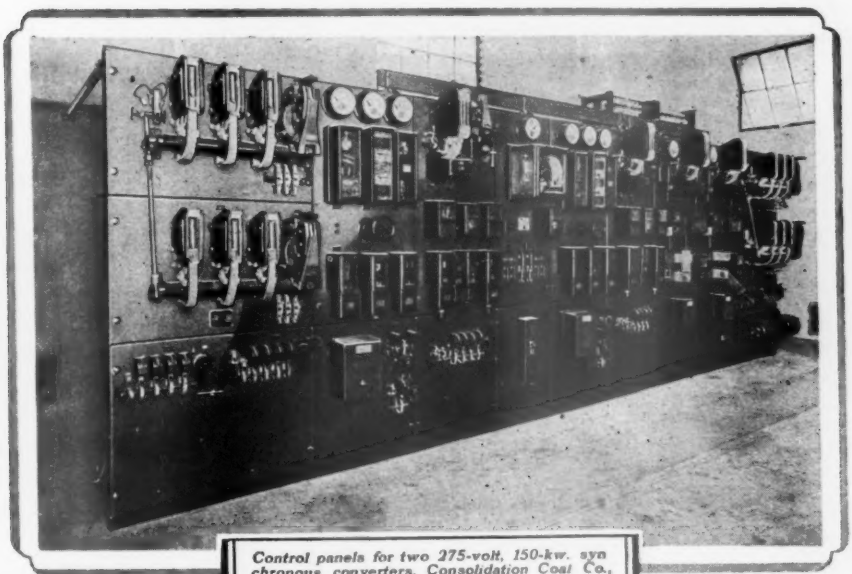
Maintenance cost is lowered—a station attendant is no longer required.

Continuity of power is improved—the duration and number of interruptions ordinarily dependent upon an operator for correction are reduced.

Better distribution voltage and smaller feeder copper investment are obtained by locating the station most advantageously.

Installation costs are low—all equipment is completely assembled and tested in the factory.

G-E automatic switching equipments are especially constructed for mine interiors where space is often limited and compactness is essential.



Control panels for two 275-volt, 150-kw. synchronous converters, Consolidation Coal Co., Jenkins, Ky.

Your purchase of G-E automatic switching equipment is assurance of a permanent source of renewal parts and the services of a nation-wide organization of specialists. For complete information on this type of equipment, ask the nearest G-E office for a copy of GEA-153.

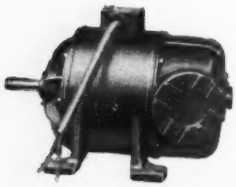
460-20

ELECTRIC

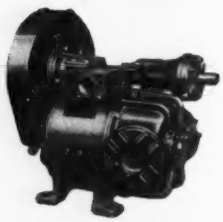
SALES OFFICES IN PRINCIPAL CITIES

Gassy Mines Made Safer

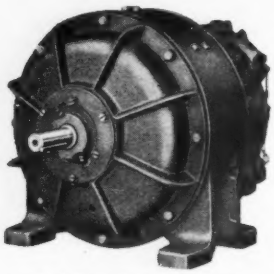
by this new line of motors



G-E 1-h.p Class BM motor



G-E 1-hp. Class BM motor with back gears



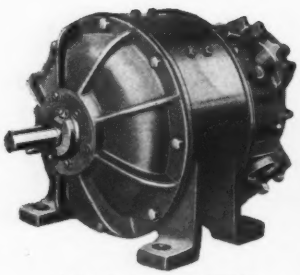
G-E 3-hp. Class BM motor

These motors have been designed to meet requirements of the U.S. Bureau of Mines for equipment permissible for use in mines where gases may be present.

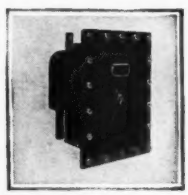
The motors and the control are totally enclosed; they are constructed to withstand internal explosions without injury, and to cool the escaping gases below the ignition point of any surrounding gas. That means safety. You can place gathering pumps, room conveyors, rock-dusters, compressors, and similar equipment where they will operate most effectively and efficiently —with the assurance that you are adopting the very latest practice in protecting your mines and your men.

This is the present G-E line; other ratings will be available in the near future. Consult your nearest G-E office for complete details.

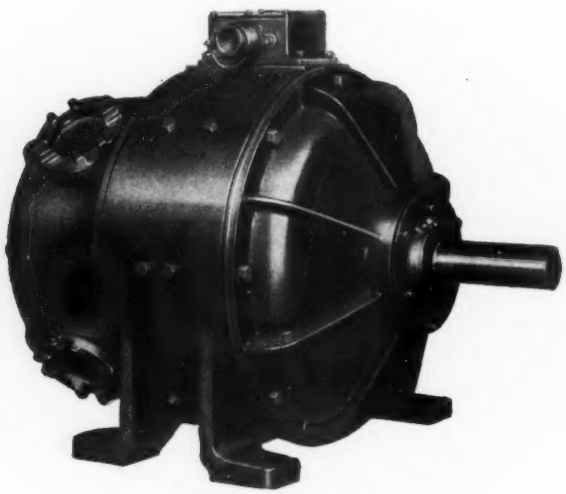
The G-E Class BM one-, three-, and five-hp. d-c. motors have passed the Bureau of Mines inspection and tests; and when connected to a machine and submitted to the Bureau, no additional tests of motors and control are necessary for complete approval. The fifteen-hp. motor, similar in design, is now undergoing the Bureau's tests.



G-E 5-hp. Class BM motor



G-E across-the-line starter for Class BM motors of 5 hp. or less



G-E 15-hp. Class BM motor

Motorized Power
–fitted to every need

231-17

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

Allis-Chalmers Motor and Texrope Drive operating Deister-Overstrom Concentrator, Alliance Mining Co., Kaska, Pa.

Unusually severe conditions met with complete satisfaction

THE intermittent shock loads of concentrators are especially tough on motors coupled through inflexible drives. Hour after hour the motor must undergo constantly repeated shocks. This necessitates frequent inspection of the motor and also shortens its life considerably.

The Texrope Drive provides a flexible coupling between the motor and the driven machine. It absorbs all the shocks that would otherwise be transmitted to the motor. In addition to this Texropes require no lubrication and may be operated on extremely short centers. The Texrope Drive is positive, flexible and has a proven efficiency of 98.9%.

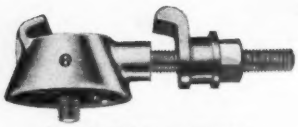
Allis-Chalmers roller bearing motors require only infrequent attention—greasing only a few times yearly. The windings are acid and moisture resisting. Timken bearings permit perfect enclosure and keep out all dirt and dust. These with the steel frames and silver brazed, indestructible rotors contribute to economy and endurance.

ALLIS-CHALMERS MANUFACTURING COMPANY, MILWAUKEE

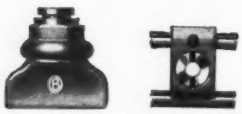
Sales Offices in all Principal Cities

ALLIS-CHALMERS MOTORS and TEXROPE DRIVES

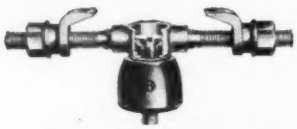
THEY are NEW!



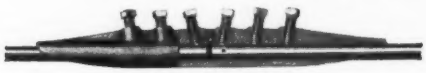
Insulated I-Beam Hanger
A very convenient means of attaching hangers to I-Beam roof supports. Combines a hanger and I-Beam clamp at very low cost. Turn to page 9 of the O-B Catalog Supplement for full information.



Dual Bulldog Trolley Clamp and Mine Catenary Clamp
Trolley and feeder lines are supported by one clamp. Catenary clamp used for supporting wires at center of span. Assembly requires little head room. Listed on page 4 of the O-B Catalog Supplement.



Special I-Beam Clamp
Has the advantages of double insulation when used on grounded I-Beams. Will fit any size of rail or I-Beam. Page 8 of the O-B Catalog Supplement gives the full ordering information.



MCM Trolley Splicer
The best splicer ever developed. Only three operations required to install. You will find the listings of this splicer on page 5 of the O-B Catalog Supplement.

MBC Trolley Frog
This frog when properly placed will work very satisfactorily on any degree of turn-out. Simplifies the problem of stocking frogs. Described on page 7 of the O-B Catalog supplement.

SEE THEM at

O-B Trolley Shoe
The shoe which saves hundreds of dollars in collector replacements. For heavy haulage currents only. Listed on page 6 of the O-B Catalog Supplement.

Improved Fused Trolley Tap
A means for safe and positive protection to mining machines. Fuse lips will not twist off in case See page 2 of the O-B Catalog Supplement.

American Mining Congress
May 7-11 '28
O-B WILL BE THERE AT
SPACES 55-57 AND 98-100

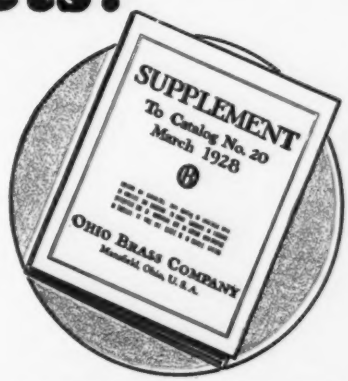
CINCINNATI

Mining Men See Lower Costs in all These New Products!

YOU may or you may not have seen them before. But the men who have seen and are using them, all agree that these devices lower their maintenance and replacement costs. Why this is true is easily apparent when the devices are actually seen.

Are you coming to Cincinnati? When you do be sure to "drop around" to the O-B exhibit and see these new products. They will be shown there for the first time. Look them over; see how well they will fit your needs and how they are made to withstand hard service. Find out how they will lower your costs too.

The O-B man will be there ready to give you the full information.



Use This Coupon →

Make your big O-B Catalog complete by asking for your copy of the O-B Catalog Supplement. It contains, in a permanent form, complete information—specifications and catalog numbers on these new devices shown here and many others.

Ohio Brass Company, Mansfield, Ohio
Canadian Ohio Brass Co., Limited
Niagara Falls, Canada
847M

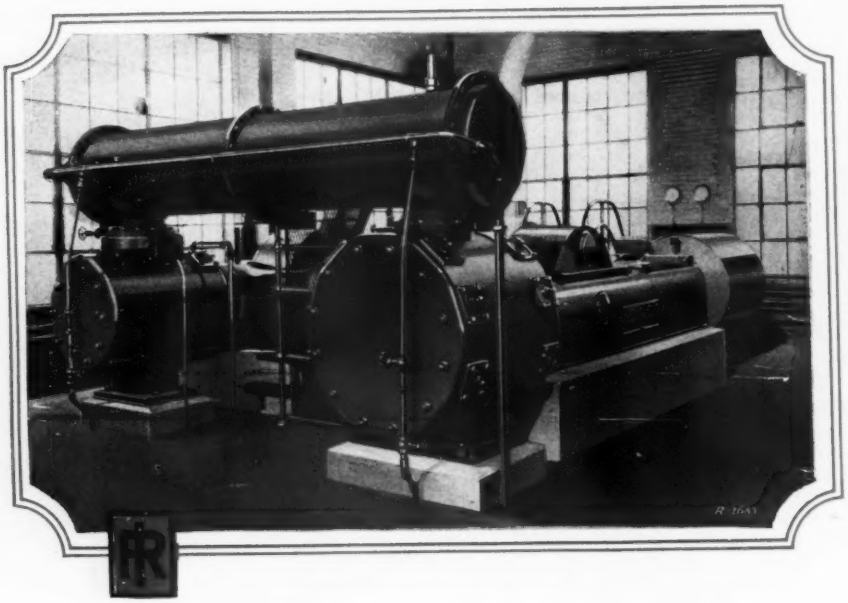
Ohio Brass Company, Mansfield, Ohio
Kindly send me a copy of the Supplement No. 1 for my big O-B Catalog.

Company Name .....
Individual .....
Title .....
Street Address .....
City ..... State .....
847M

Ohio Brass Co.

NEW YORK CHICAGO PHILADELPHIA PITTSBURGH ATLANTA ST. LOUIS SAN FRANCISCO CLEVELAND LOS ANGELES

PORCELAIN INSULATORS
LINE MATERIALS
RAIL BONDS
CAR EQUIPMENT
MINING MATERIALS
VALVES



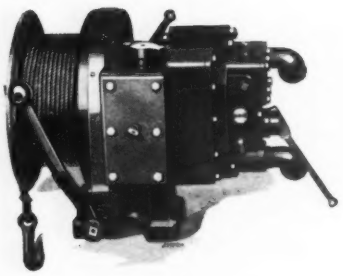
A Type XPV steam-driven compressor installed in one of the large mines in the Pennsylvania Anthracite District

Always Permissible ——

COMPRESSED air is safe underground or above ground, and presents no hazard in the gaseous mine. It is an effective medium for operating drills, cutters, hoists, pumps, and other labor-saving equipment of the modern mine. Piped from a central compressor station or supplied by portable mine car compressors near the points of use, it is always permissible.

Ingersoll-Rand Compressors are made in so many types and sizes that it is an easy matter to select a machine to meet the individual requirements of any mine. They are highly efficient under full load or partial load—an important consideration where the air demand varies greatly during a mining shift. Their many refinements and special features insure delivery of air at the lowest possible cost per cubic foot.

Air-operated Little Tugger Hoists save time and money in loading and switching cars, handling materials, and performing many other underground operations.



The 9-H Little Tugger Hoist

INGERSOLL-RAND COMPANY

11 Broadway New York City

Offices in Principal Cities the World Over

For Canada Refer—Canadian Ingersoll-Rand Co., Limited
10 Phillips Square, Montreal, Quebec

911-C.

Ingersoll-Rand

First in America to make carbon brushes

SO FAR as we have been able to ascertain, the first carbon brushes made in America were manufactured in the original National Carbon Company plant in Cleveland, in 1887. For eleven years before that date the company had been making arc lamp carbons, battery carbons and similar products. This experience in the handling of carbon was turned to immediate advantage when the first experiment with carbon brushes proved a startling success. Brushes were made for the Thomson-Houston Co., the Edison Company, General Electric Company, Westinghouse Electric & Manufacturing Co., Western Electric Co., the American Engine Co., Eddy Electric Mfg. Co., and the Bullock Electric Co., now the Allis-Chalmers Mfg. Co. Many other companies that were active during the early days of the electrical industry were also supplied.

Proud as we are of this record, we are still prouder of our present clientele, including as it does the vast majority of manufacturers of electrical apparatus, and of producers and users of electrical current.

NATIONAL CARBON COMPANY, INC.

Unit of Union Carbide UCC *and Carbon Corporation*

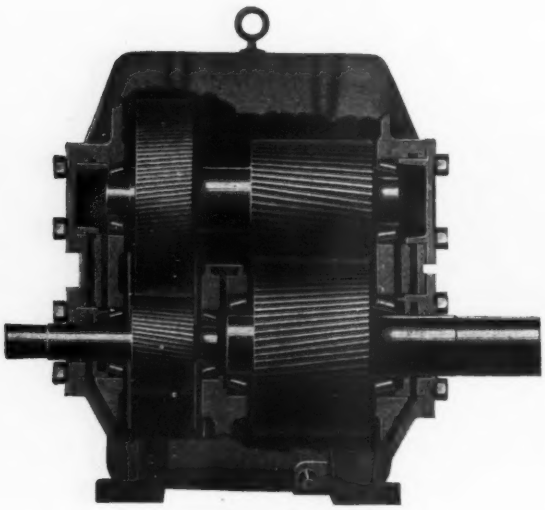
Carbon Sales Division

Cleveland, Ohio — SILVER STRAND CABLE TRADE MARK REGISTERED — San Francisco, Cal.

Branch Offices and Factories

CHICAGO, ILL. PITTSBURGH, PA. JERSEY CITY, N. J. BIRMINGHAM, ALA.

What you want to know



Double Reduction Speed Reducer, Type DVR., Ratio 47:1

A group of Nuttall heat-treated and hardened, mining machine gears.

SPEED REDUCERS

Nuttall Helical Gear Speed Reducers are plain and durably constructed; designed to give continuous, trouble-free operation even in the most strenuous service with no attention beyond occasional lubrication.

To give great strength and smooth, quiet operation, these speed reducers are equipped with Nuttall heat-treated and hardened Single Helical Gears; Timken Roller Bearings assuring dependability and high efficiency of the bearings; a rigid reinforced case giving perfect alignment of shafts and gears and the Nuttall System of positive splash lubrication insuring an oil film on wearing surfaces at all times, all of which reduces maintenance to a very minimum.

Single Reduction Speed Reducers are rated up to 450 hp., and have a maximum reduction of 8:1.

Double Reduction Speed Reducers are rated up to 200 hp., and have a maximum reduction of 47:1.

Send for our Speed Reducer Bulletin No. 59.

MINING MACHINE GEARS

Nuttall gears have a reputation among mining men for giving an excellent account of themselves. They operate smoothly, with a minimum amount of vibration and noise; and on the toughest jobs they have proved their stamina. Everywhere that gearing is used; on locomotives, on mining machines, on pumps, hoists, conveyors, or fans, Nuttall gears have made service records which have earned them the respect of mine operators. They have proved their quality by their performance.

Other Nuttall products, trolleys, flexible couplings and Nuttall speed reducers and gear units, all bear the same enviable reputation. It is the logical result of the one manufacturing policy of the Nuttall Company for the past forty years—QUALITY ALWAYS.

Send for our "Mine and Industrial Catalog", No. 16

R. D. NUTTALL CO., Pittsburgh, Pa.

Lyman Tube & Supply Co., Montreal, Toronto, and Vancouver, Canada

Jobbers, Banks-Miller Supply Co., Huntington, W. Va.
Superior Supply Co., Bluefield, W. Va.

All Nuttall Products are sold through the Westinghouse Electric & Mfg. Co., district offices. Refer your inquiries to the nearest Westinghouse Office.

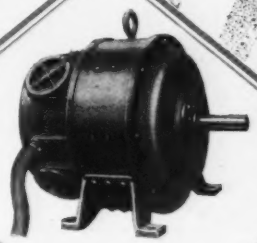
Nuttall

AT THE AMERICAN MINING CONGRESS

CINCINNATI MAY 7—11

Explosion-proof Controller

Room Hoist Motor



Explosion-proof SK Motor

Keeping Pace With Mechanization

THE increasing necessity for lower operating costs has unquestionably emphasized the many economic advantages of mechanization in the coal industry. Credit for the savings made possible by the mechanization of mines rests largely with the electric motor and its control.

For gaseous mines, Westinghouse has developed a complete line of explosion-proof motors and control based on years of experience in building direct-current apparatus. The equipment is totally enclosed in a heavy cover, making it safe against the hazards of gas or dust.

Another forward step in the mechanization of coal mines is exemplified in the development of the Room Hoist Motor. Designed to meet the need for quick, scheduled haulage, this unit provides an important auxiliary in the gathering service. It is built to withstand the gruelling operating conditions common to mines.

On the surface, or in the mines, Westinghouse is prepared to serve in any electrical capacity.

Westinghouse Electric & Manufacturing Company
East Pittsburgh Pennsylvania

Sales Offices in All Principal Cities of the United States and Foreign Countries

Booths 99 to 111

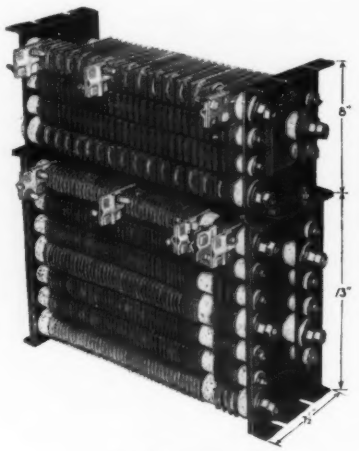
Westinghouse

X98101

90 days FREE TRIAL on a P-G Steel Resistance Grid

P.-G. Steel Grid Resistances are guaranteed for 12 Months Service from Date of Shipment.

These grids are used on Mine Locomotives, Coal Cutters, Loaders, Conveyors, Fans, Pumps, Hoists and for all services requiring a grid type Resistor.



Locomotive Type

The Post-Glover Electric Co.

221 West Third St., Cincinnati, Ohio

Distributors

Gellatly & Co., Pittsburgh, Pa.
Coffin & Smith, Scranton, Penna.
Gee Electric Co., Wheeling, W. Va.
Howard-Beatty Electric Co., Hazard, Ky.
J. T. Sudduth & Co., Birmingham, Ala.
R. H. Moran & Co., Madisonville, Ky.
W. W. Baker, 140 S. Dearborn St., Chicago, Ill.
Kester Electric Co., Terre Haute, Ind.
A. F. Krippner, Denver, Colo.
Logan Hardware & Supply Co., Logan, W. Va.

UNDERGROUND TRANSPORTATION

TIMKENS

In Cars, Locomotives, Journals, Motors,

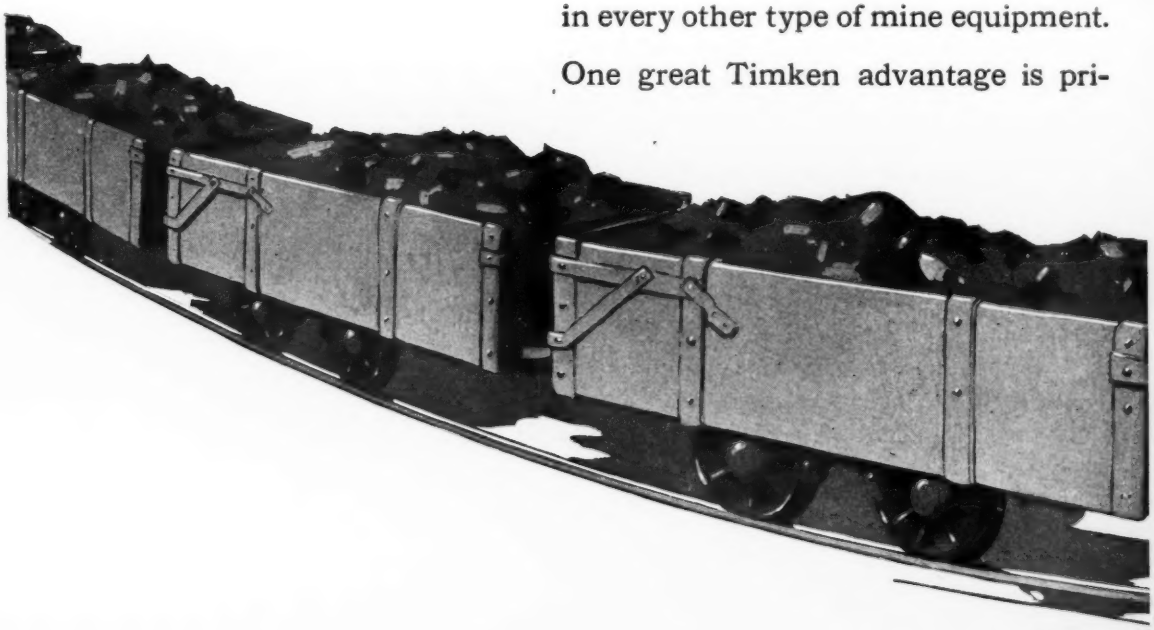
"More Than Anti-Friction Bearings!" LEARN WHY at the Show Spaces 59 and 102

Timken-equipped car journals are fast displacing all other types simply because the Industry has found that Timken Bearings mean lower costs and higher production.

On great properties, in thousands of cars, sponsored by noted equipment builders, Timken Bearings made records which established them as the standard for locomotive journals also.

And now when modern design calls for anti-friction locomotive motors, Timken Bearings are logically becoming the outstanding choice, as they are in every other type of mine equipment.

One great Timken advantage is pri-



TIMKEN *Tapered Roller*

SWEEP ON!

Conveyors and All Mine Equipment

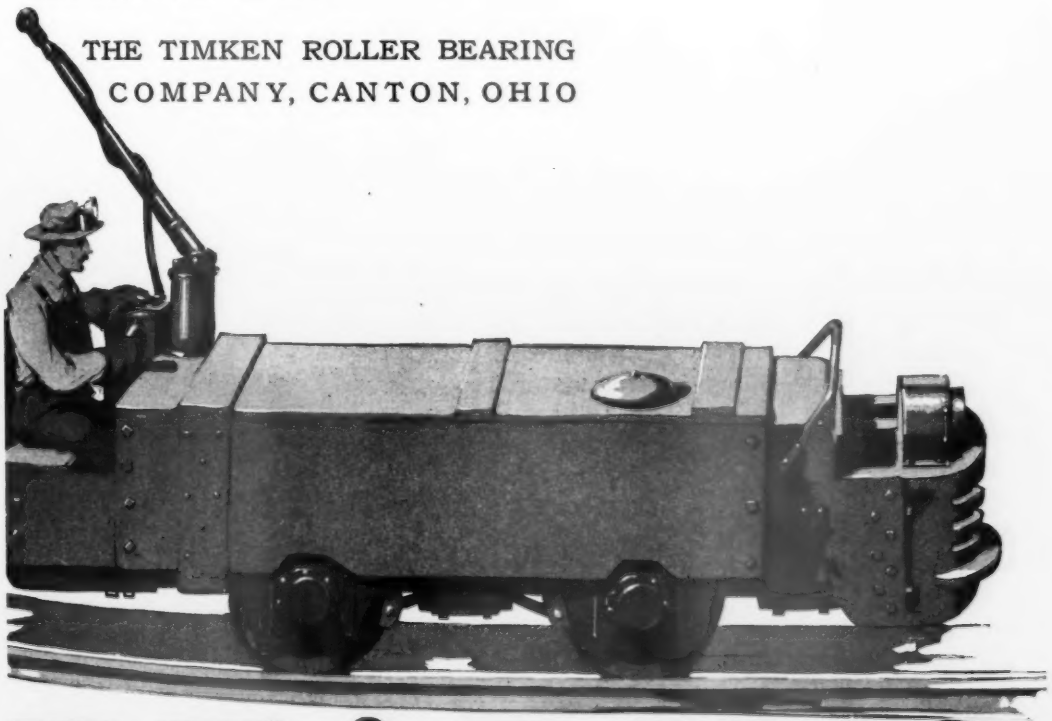
marily responsible—Timken self-contained full thrust-radial capacity—the result of Timken tapered construction, Timken *POSITIVELY ALIGNED ROLLS*, and Timken-made electric steel.

That is the source of complete protection against friction, thrust, shock, and radial loads in compact, simple, well-sealed Timken mountings.

Specify Timken Bearings, lubricate merely a few times a year, and wipe out a great part of all maintenance and depreciation cost.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

The largest locomotive ever built for underground haulage is on display at the Westinghouse Booth. The journals and armatures of this 38-ton locomotive are equipped with Timken Bearings.



BEARINGS

DERAILMENTS COST

Tonnage Dollars Disappear every time a Locomotive Leaves the Track

If You Could Stop Derailments You Could—

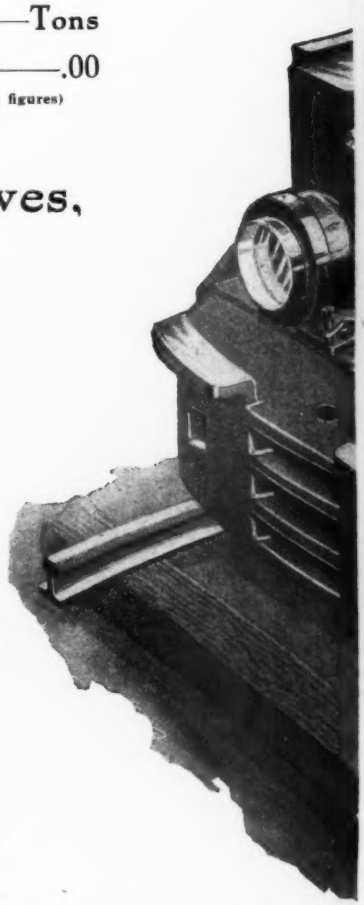
Increase Your Tonnage.....————Tons

Save Your Company.....$————.00
each month!
(Fill in your own figures)

YOU CAN, with Goodman Locomotives, because the —

Transverse Equalizer, and the "Universal Joint" Motor Supports

Keep Goodman Locomotives on the Track



SEE HOW FOR YOURSELF:

The **TRANSVERSE EQUALIZER** distributes the weight of the locomotive evenly on all four wheels when passing over obstructions or depressions on the track. Through the action of this Equalizer, the locomotive frame balances as though the front truck were pivoted to the center of the frame, thus affording a perfect three-point frame support. Its action is independent of, and additional to, the flexibility of the axle box springs. (An exclusive Goodman patented feature).

The construction is simple. There are 9 working parts, all of heavy steel—4 frame brackets, 2 cranks, 2 spring seats and 1 connecting or cross bar.

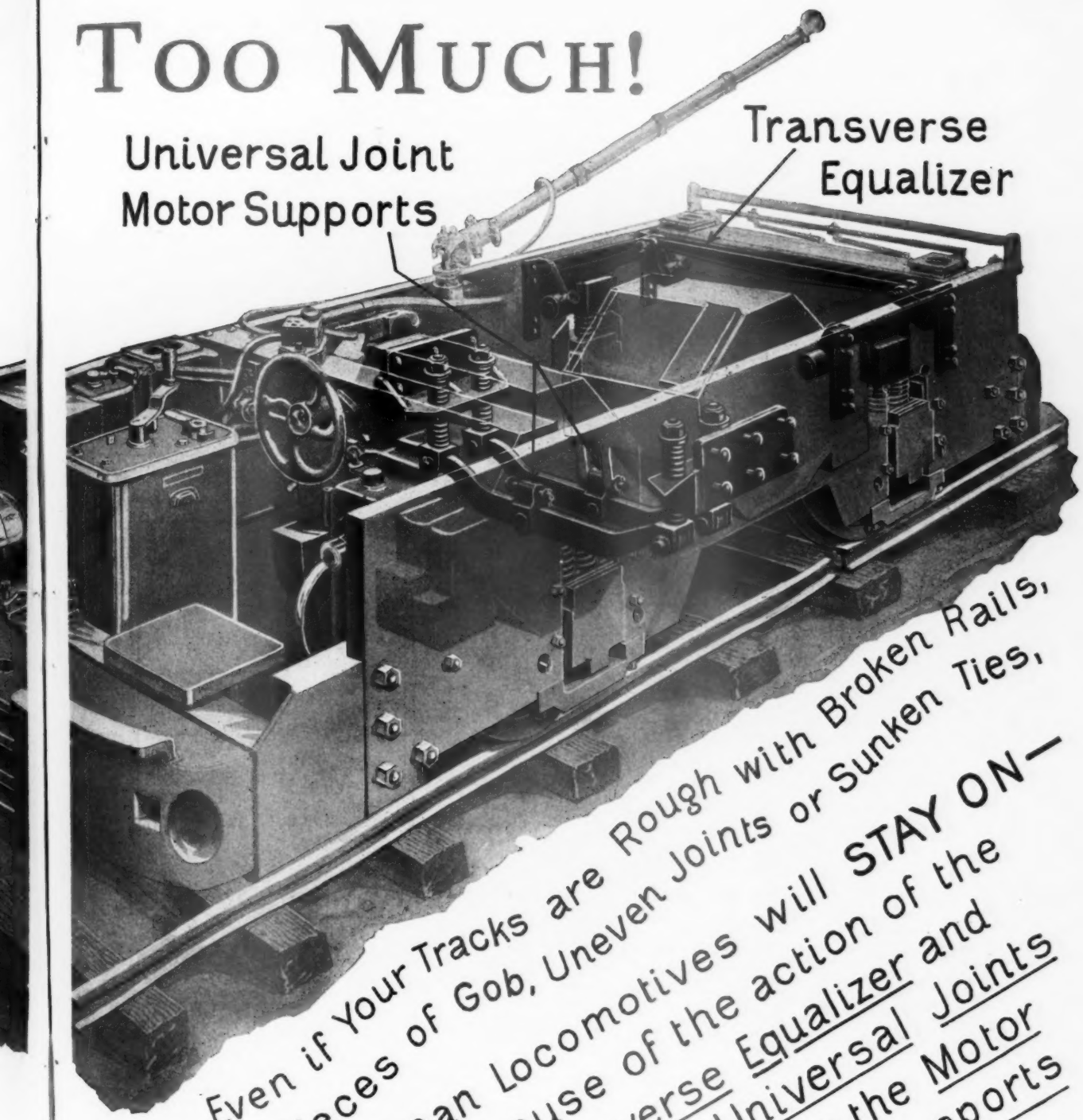
The "**UNIVERSAL JOINT" MOTOR CONNECTION** between the motor and its support consists of a large double-pinned forged clevis. One pin fastens this clevis to the motor supporting bar and the other pin secures the clevis to the two lugs on the motor shell. This connection gives a universal flexibility for the motor and makes the motor free to move in every direction—up, down, sidewise or at any angle.

This Greater Freedom given the Wheels and Motors Keeps Goodman Locomotives ON THE TRACK!

Consider this Derailment Saving when you Purchase your next Locomotive

(86)

TOO MUCH!



Even if Your Tracks are Rough with Broken Rails, Pieces of Gob, Uneven Joints or Sunken Ties, Goodman Locomotives will STAY ON— Because of the action of the Transverse Equalizer and the Universal Joints in the Motor Supports!

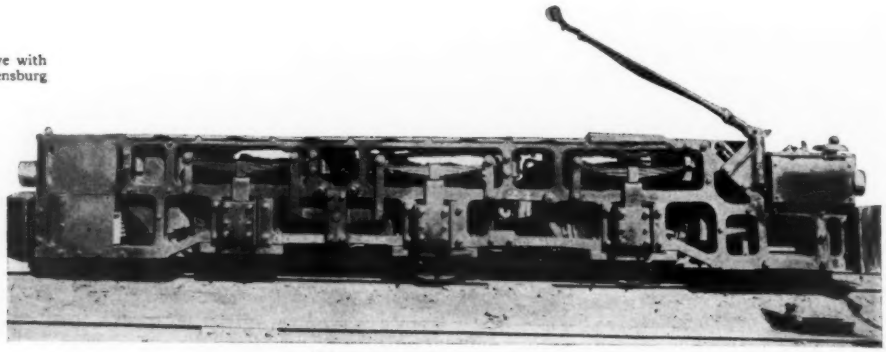
GOODMAN MANUFACTURING COMPANY
HALSTED ST. at 48TH
CHICAGO - - - ILL.

Locomotives - Loaders - Coal Cutters

PITTSBURGH - CHARLESTON, W. VA. - HUNTINGTON, W. VA. - CINCINNATI - BIRMINGHAM - ST. LOUIS - DENVER - PRICE, UTAH

Baldwin-Westinghouse

22½ ton, three-motor locomotive with semi-magnetic control for the Ebensburg Coal Company.

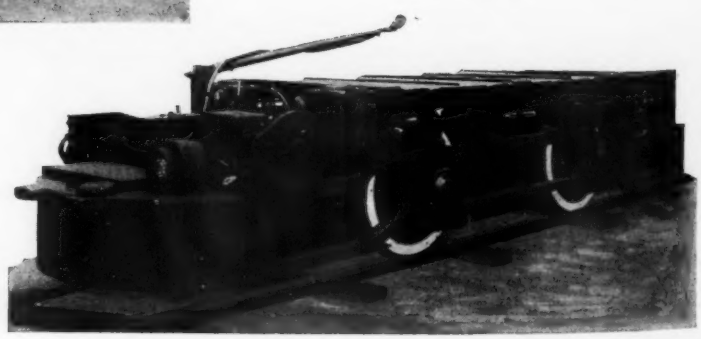


15-ton, three-motor locomotive for the Rail & River Coal Company.

Company	No.	Tons Each	Hp. Each
Berwind-White Coal Mining Co.	2	38	390
Ebensburg Coal Company	2	22½	270
Tennessee C. I. & R.R. Co.	2	20	250
Pemberton Coal & Coke Co.	2	15	260
Woodward Iron Co.	1	15	260
Tennessee C. I. & R.R. Co.	1	15	260
Cambria Fuel Co.	1	15	180
Monroe Coal Mining Co.	2	15	150
Wolf-Summit Coal Company	1	15	180

35-ton, three-motor locomotive for Berwind-White Coal Mining Company.

20-ton, two-motor locomotive with semi-electro-pneumatic control, airbrakes and pneumatic sanders for the Bertha Consumers Company.



Keep the Overhead down by keeping it up with Westinghouse Line Material

X98110.

Super-Powerful Locomotives

introduce

A New Era in Coal Transportation

MODERN methods and machines, where applied in recent years, have continually increased the possibilities of mine production.

Because of this situation, hauling the coal out to the shipping point has taxed the mine motive power facilities severely. This has resulted in increased maintenance and operating costs and frequent interruptions in the coal movements due to breakdowns and other causes.

Baldwin-Westinghouse super-powerful electric locomotives for heavy haulage mine service are unquestionably the most important development during the year in effecting the "railroading" of coal at reduced cost and increased reliability.

These sturdy, high-powered locomotives are now available in weights up to 38 tons and with capacities as high as 390 total horsepower supplied by powerful motors.

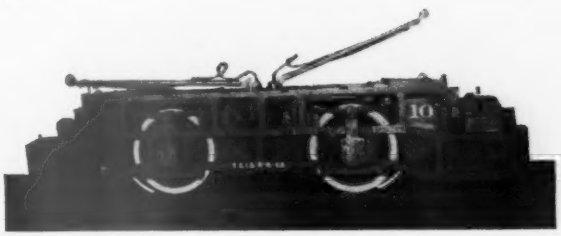
The tabulation on the opposite page indicates the preference of leading operators for Baldwin-Westinghouse super-powerful locomotives for heavy haulage service.

The Westinghouse representative in your locality is ready to discuss your transportation problems with you, and tell you the merits and operating advantages of this line of locomotives.

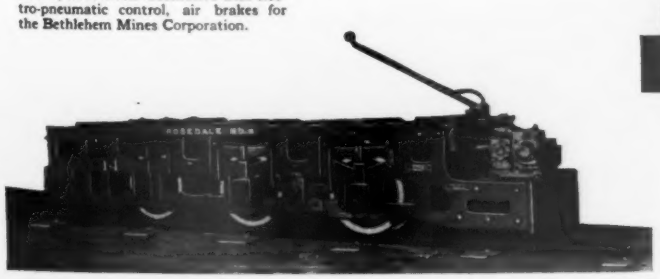
The Baldwin Locomotive Works
Philadelphia, Pa.

Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

15-ton, two-motor locomotive with semi-magnetic control for the Tennessee Coal, Iron & Railroad Company.



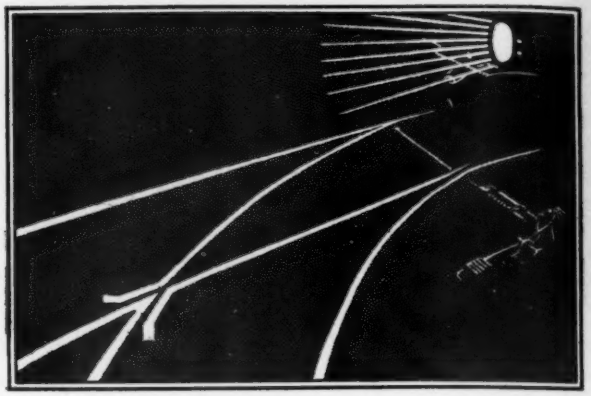
35-ton, three-motor locomotive with electro-pneumatic control, air brakes for the Bethlehem Mines Corporation.



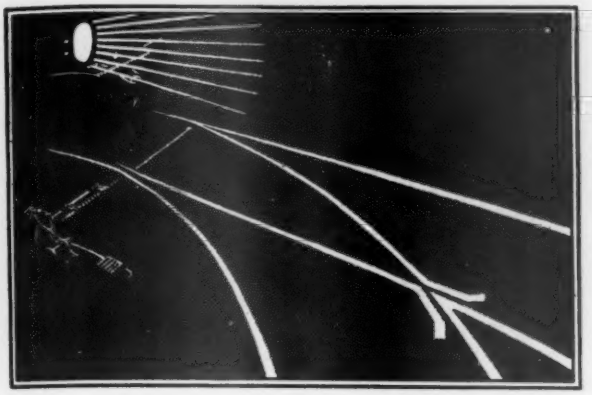
See the world's largest locomotive for underground coal haulage, in the Westinghouse Booth at the Mining Congress Convention, May 7-11.

Baldwin-Westinghouse

X98110



CENTRAL
MINE TRACK EQUIPMENT



TRACK takes on new significance with each improvement in mining methods or equipment that tends to speed production. Out of the confusion of new mining methods stands this one fact that must not be slighted—*track delivers the goods.* Are you getting all that you should from your haulage system?

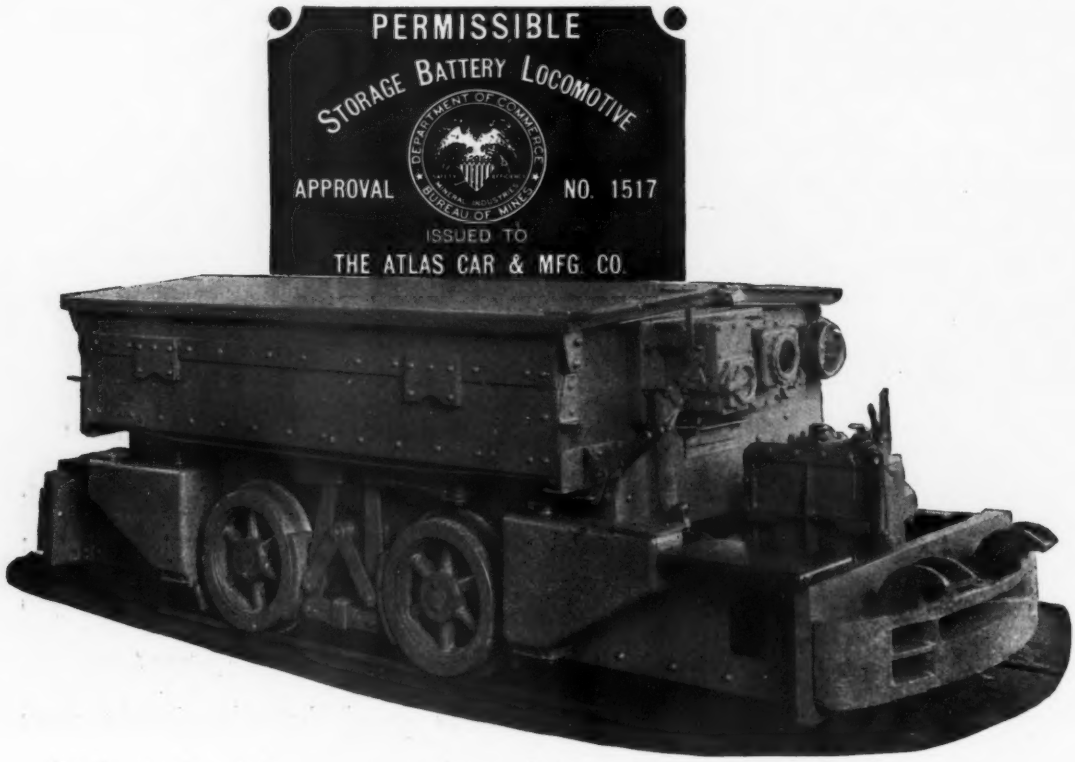
Safety of haulage as well as speed depends directly upon proper planning and good track materials. Car distribution waits upon the layout and better distribution reduces the haulage equipment requirements. Derailments and other costly delays are eliminated. Standardization due to a proper plan facilitates replacements and reduces the track man's labor.

Call on our engineers for their experience and advice.

See our exhibit at Cincinnati.

THE
CENTRAL FROG & SWITCH CO.
CINCINNATI, OHIO

CENTRAL
MINE TRACK EQUIPMENT



SAFETY AND PERFORMANCE

The Atlas Storage Battery Locomotive has been approved by the United States Bureau of Mines for use in gaseous mines. It is safe so far as human foresight can make it safe.

No sacrifice of the high performance qualities for which the Atlas Locomotive is noted was necessary to make it safe. These performance qualities actually were improved.

"Atlas Does Haul More Coal"

with a smaller expenditure of battery power than any other locomotive.

It is *never* necessary to change batteries during the working shift in gathering service when using Atlas Permissible Locomotives.

Pond Creek Pocahontas Company at Bartley, W. Va., will tell you things about this machine which are surprising.

An A. C. Nielsen Co. survey gives authentic details.

The Atlas Car and Manufacturing Co.

Engineers *Manufacturers*

CLEVELAND, OHIO

ELECTRIC AND STORAGE BATTERY CARS FOR EVERY HAULAGE REQUIREMENT.
SCALE CARS—TRANSFER CARS—CONCENTRATE CARS
COKE PLANT MACHINERY

Improved
Spur Gear Drive
Lower Unit Cost
Storage
Battery
Locomotive

For
Tramming
Service
in
Metal Mines

1½ TON TYPE J

Spur Gear Drive Storage Battery Locomotive

Track Gauge	18 inches to 24 inches
Length over all on cage	47 inches
Height over all of headlight	50 inches
Width	32½ inches
Speed	2½ to 6½ miles per hour
Rated Drawbar pull	400 lbs. at 3½ miles per hour

Lower Unit Cost—
—Lower Maintainance Cost—
—Lower Haulage Cost

ADAPTABILITY — EFFICIENCY — ECONOMY

ONLY ONE OF THE MANY TYPES OF ATLAS LOCOMOTIVES—A TYPE AND SIZE FOR ANY HAULAGE REQUIREMENT TO PROVIDE LOWER HAULAGE COSTS

The Atlas Car and Manufacturing Co.

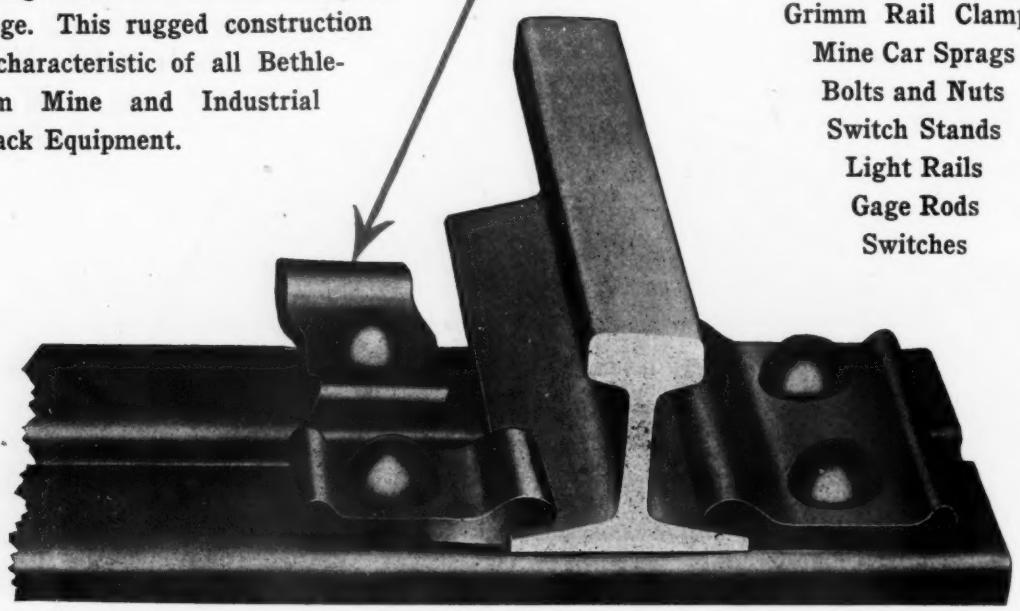
Engineers *Manufacturers*

CLEVELAND, OHIO

ELECTRIC AND STORAGE BATTERY CARS FOR EVERY HAULAGE REQUIREMENT.
SCALE CARS—TRANSFER CARS—CONCENTRATE CARS
COKE PLANT MACHINERY

You get this *Extra Clip*

THE BETHLEHEM DOUBLE CLIP MINE TIE has a broad stationary clip and TWO locking clips to hold the rail. As one locking clip is ample for any ordinary service, the two provide a fastening of such strength as to stand the roughest usage. This rugged construction is characteristic of all Bethlehem Mine and Industrial Track Equipment.



Listed below are a few of the other Bethlehem Products for mine and industrial railways:

Industrial and Mine Cars
Coupling Pins and Links
Grimm Rail Clamps
Mine Car Sprags
Bolts and Nuts
Switch Stands
Light Rails
Gage Rods
Switches

Be sure to see the Bethlehem Exhibit at the American Mining Congress Exposition, Cincinnati, May 7-11.

BOOTHS 68 to 74 and 273 to 279

BETHLEHEM STEEL COMPANY, General Offices: BETHLEHEM, PA.

DISTRICT OFFICES:

New York Boston Philadelphia Baltimore Washington Atlanta Pittsburgh Buffalo
Cleveland Detroit Cincinnati Chicago St. Louis San Francisco Los Angeles Seattle Portland

Bethlehem Steel Export Corporation, 25 Broadway, New York City, Sole Exporters of Our Commercial Products

BETHLEHEM

INDUSTRIAL and MINE TRACK EQUIPMENT

Putting carefree performance into all your mine cars

Since 1908 Hyatt Roller Bearings have been used in mine car journals with great satisfaction.

Twenty years of carefree, economical bearing performance.

Saving money for mine operators . . . by reducing friction, maintenance and lubrication expense—speeding up production—making possible longer trains of cars.

Such advantages and economies prove that it pays to Hyattize your equipment.

At the National Exposition of Coal Mine Equipment, Cincinnati, Hyatt Booth numbers are 286 and 288.

HYATT ROLLER BEARING COMPANY

Newark Chicago Detroit Pittsburgh Oakland

HYATT

ROLLER BEARINGS

PRODUCT OF GENERAL MOTORS

THE new a.c.f. wheels cost more. They do more. These wheels are the development of an intensive campaign to increase the service of mine car wheels. Although our wheels were already good we have discovered many ways, big and little, to improve them. The thorough tests we have given the new product rates them with double the wearing qualities of former good wheels. Let us explain further the tests they have been subjected to. See them and hear more about them at Cincinnati.

Buy a.c.f. *Cars*

American Car and Foundry Company

New York, Berwick, Pa. — St. Louis, Bloomsburg, Pa. — Chicago, Huntington, W. Va. — Pittsburgh, Terre Haute, Ind. — Buffalo

a.c.f.

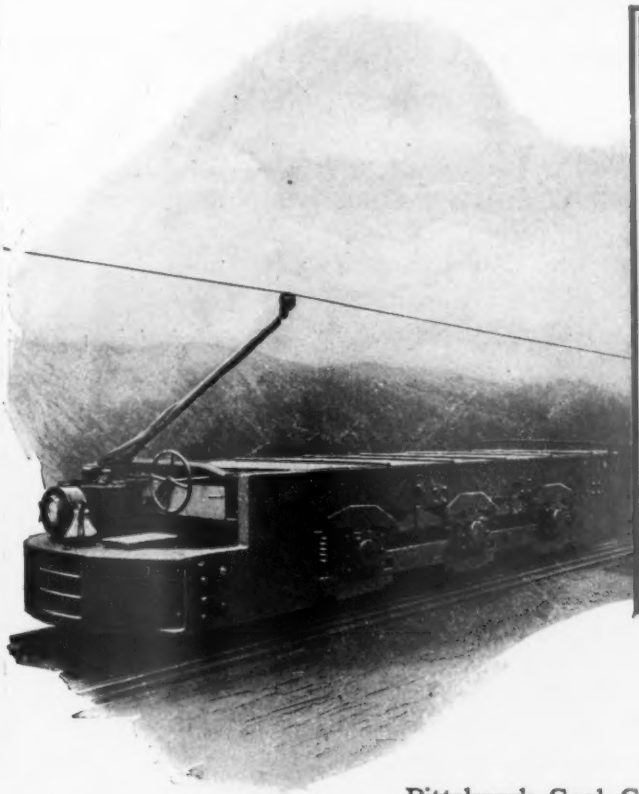
CAR FOUNDRY

ELECTRIC RIVET HEATERS
BARS, IRON and STEEL
CAR IRONS

BOLTS, NUTS, RIVETS
IRON BODY GATE VALVES
CAR TRUCKS

CHILLED TREAD WHEELS
PINS AND LINKS
FLANGED PIPE

51 G-E Locomotives in Pittsburgh Coal Co. Mines



Distinctive Features of the G-E Mining Locomotive

1. Frames cut from solid rolled steel insure maximum strength.
2. Leaf springs with equalizers—originated by General Electric for modern mine locomotives—hold locomotive to the track.
3. Motors unequalled by any others used on mining locomotives—embodying the experience gained in building 5000 traction motors per year.
4. Control of the Series-parallel type—either drum or contactor—produces economies in maintenance and power consumption.
5. Accessibility of all wearing parts is exceptional.
6. Safety: Locomotives and operators protected by dependable and easily operated brakes; adequate space for operators; spring suspension minimizes number of derailments; equipment protected by reliable overload devices.
7. Economy: Series-parallel control necessitates starting and slow running in series—this results in low power consumption; spring suspension keeps down locomotive and track maintenance; the absolute reliability of G-E locomotives is translated into faster and more continuous production.

Pittsburgh Coal Company uses 51 G-E locomotives in hauling the huge tonnages of its extensive properties.

G-E locomotives are quick starters. Economical, trouble-free, and easy to control, they furnish the most satisfactory tractive power your collieries can have.

Gathering and hauling with G-E locomotives means modern, no-delay transportation—at minimum cost.

The leading coal mines in the country depend on G-E locomotives. Information and complete service await you at your nearest G-E office.

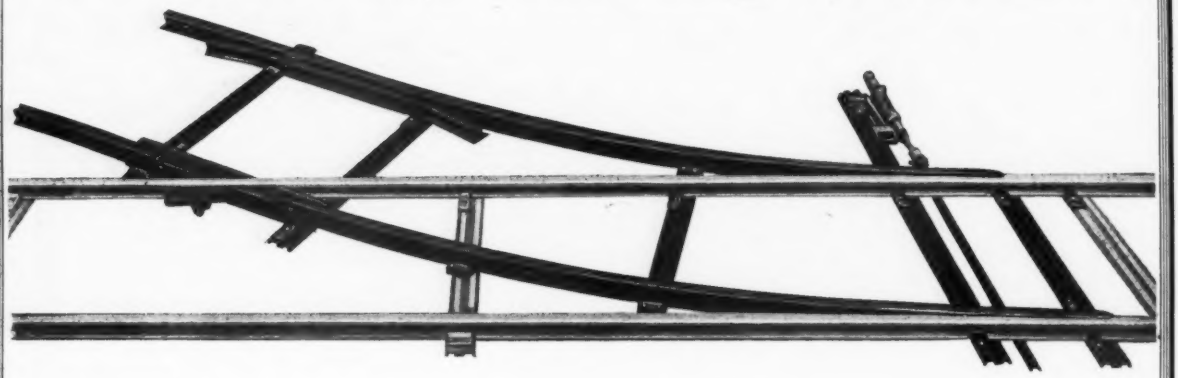
360-20

GENERAL ELECTRIC

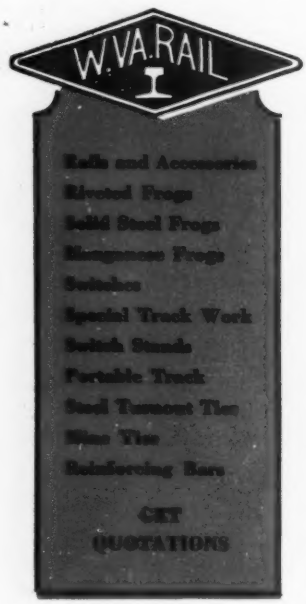
GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

Announcing

A New Portable Turnout for Modern Mining Methods



SEE this new development in Track Work at the Cincinnati Convention—Booths 10 and 12.



"Consult our Track Specialists about track problems"

In keeping with "West Virginia's" policy of anticipating the needs of the coal industry, we announce a new Portable Turnout or passing siding that will greatly simplify haulage problems on temporary turnouts.

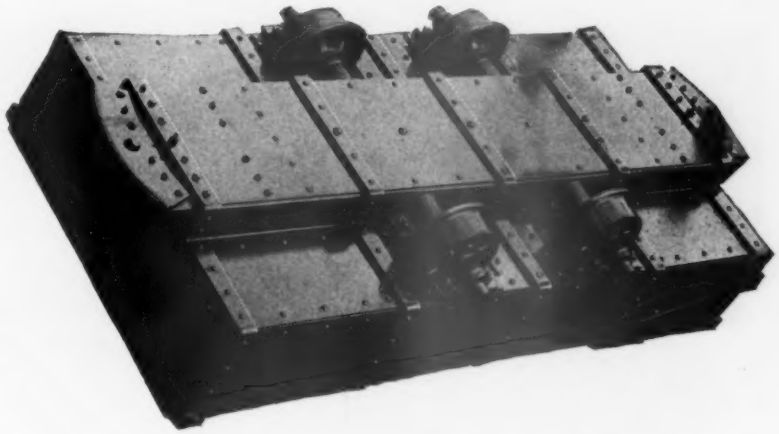
This new turnout can be installed on any track without cutting or bending the original track. It is laid in place, wedge K hammered into position, and is then ready for use. Where loading machines are used, either a turnout or a passing siding will be placed near face of coal and empty cars placed on one track and the loaded cars shoved on the other, keeping a continuous supply of cars for the loader. The new turnout can easily be moved since no permanent fastenings are used.

Our men and our plant are at your disposal, to supply you on instant notice with standard West Virginia Equipment, or to build special track work to suit special needs. One piece—or a car load lot, will be shipped within 24 hours.

***The* WEST VIRGINIA RAIL CO.**

Huntington, W. Va.

WEST VIRGINIA RAILS AND TRACK WORK



THE WHOLE STORY

is not told by this photograph

True, it shows the unbreakable, armour plate, bottom construction of this new Enterprise Car.

Derail it—haul it a mile, maul it, you can't hurt it.

But the real interest is the "Inside Story." To see how the hundreds of pounds of extra capacity are gained by unique inside construction is well worth your while.

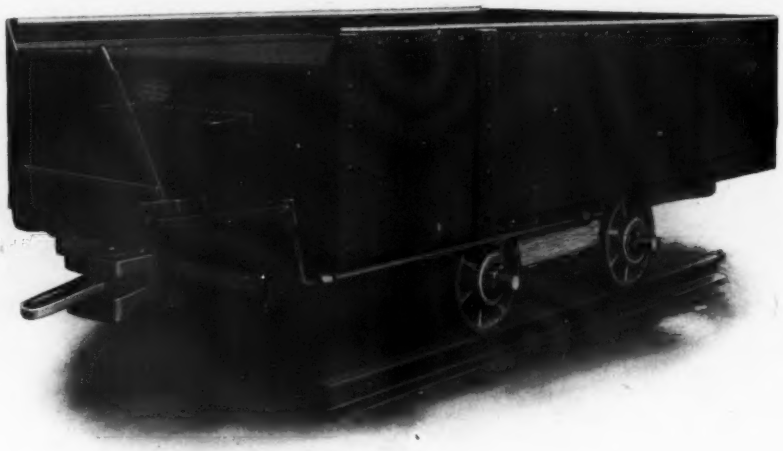
This car, full sized, right side up on its own wheels will be on exhibition at the Mining Congress Show in Cincinnati, May seventh to the eleventh. Don't miss seeing it. It will be worth your while to visit Booths Two and Four.

ENTERPRISE

WHEEL AND CAR CORPORATION

Bristol, Va.-Tenn. Huntington, W. Va.

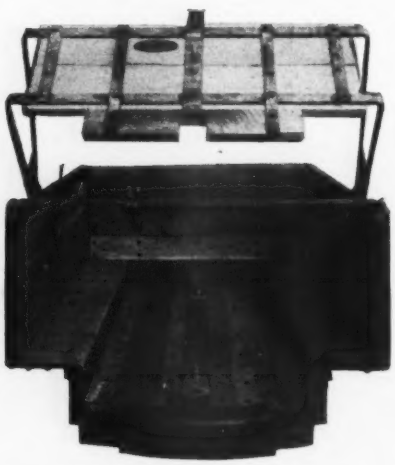
Also you can see the time tried coal hauling, power saving Enterprise Roller Bearings.



A Car Is As Good As Its Wheels

WHEELS, the feet of a mine car, are the all-important factor in the car's performance. The car body may be built of wood, of wood and steel, or all-steel (and Phillips builds all styles), but if, like human feet, wheels go flat, or if flanges break, the result is as annoying and as serious a hindrance as bad feet to human beings. Phillips cars have good feet!

Mine scrap piles tell an interesting story to those who can read their message. When a wheel reaches the scrap pile, its record of service is at an end, and then only can its full worth be determined. Phillips wheels all bear casting dates, and the scrap pile at the average mine using Phillips Wheels proves conclusively that the wheels outlast the bodies. This feature is highly desirable in roller bearing wheels, on account of the expensive preparation for the bearings.



The bodies of Phillips cars are as carefully designed and made as are Phillips wheels, and the combination can be depended upon to give splendid returns.

PHILLIPS MINE AND MILL SUPPLY CO.
PITTSBURGH, PA.

PROFITABLE

A man that computes the cost of purchase *and maintenance* will find trustworthy, husky Hockensmith cars highly profitable. They haul more coal at less cost, serve better, last longer. Next time you're in the market for mine car equipment—let Hockensmith quote.

HOCKENSMITH WHEEL & MINE CAR CO.

Penn, Pa. Long Distance Phone, Jeannette 700

SALES REPRESENTATIVES

Huntington, W. Va.—Huntington Supply & Equipment Co. **Knoxville, Tenn.—Webster & Co.**
Clarksburg, W. Va.—Mr. Norman Strugnell **Chicago, Ill.—W. W. Baker, 140 So. Dearborn St.**

PROVEN BY USE ∾ RECONDITIONED TO HIGH STANDARDS

What Do You Do When a Bearing Wears Out?

CHUCK it? The Ahlberg Ground Bearing Service offers a tremendously more profitable solution.

A bearing—especially a good bearing—represents real value, in carefully analyzed and tested metal, studied design and expert craftsmanship. When the balls and races become worn this bearing loses its anti-friction value—and yet—

It can be reclaimed—*made as good as new*—by regrinding and the installation of new balls, retainers, etc. *at a fraction of the cost of a new bearing.*

That is the Ahlberg Ground Bearing Service—*a forty per cent saving over the cost of new bearings,* with this added feature—completely stocked warehouses throughout the United States—full stocks, that place economical replacement within 24 hours of you—wherever your mine may be!

Our nearest branch will be glad to give you complete information. The saving averages 40%.

Ask the Mines Listed Below What *They* Do

Steubenville Coal Mining Co., Steubenville, Ohio; Glendale Gas Coal Co., Moundville, W. Va.; Barnett Coal Company, Latrobe, Pa.; O'Gara Coal Company, Chicago, Ill.; Valley Camp Coal Company, Parnassus, Pa.; Gay Coal & Coke Company, Logan, W. Va.; Vinton Collieries, Vintondale, Pa.; Clifty Consolidated Coal Company, Clay, Ky.; Superior Coal Company, Benld, Ill.; Glen Alden Coal Company, Scranton, Pa.; Bethlehem Mines Corp., Bethlehem, Pa. also (Wehrum, Pa.); Consolidated Coal & Coke Co., Denver, Colo.

AHLBERG BEARING COMPANY

317-327 E. 29th St., Chicago, Ill.

Akron	*Brooklyn*	*Cleveland*	*Detroit*	*Milwaukee*	*Omaha*	*St. Louis*
Atlanta	*Buffalo*	*Columbus*	*Duluth*	*Minneapolis*	*Philadelphia*	*St. Paul*
Baltimore	*Chicago*	*Dallas*	*Kansas City*	*New Orleans*	*Pittsburgh*	*Toledo*
Boston	*Cincinnati*	*Denver*	*Memphis*	*New York*	*Providence*	*Washington*
						Youngstown

DISTRIBUTORS

Beckley Machine & Electric Co., Beckley, W. Va.

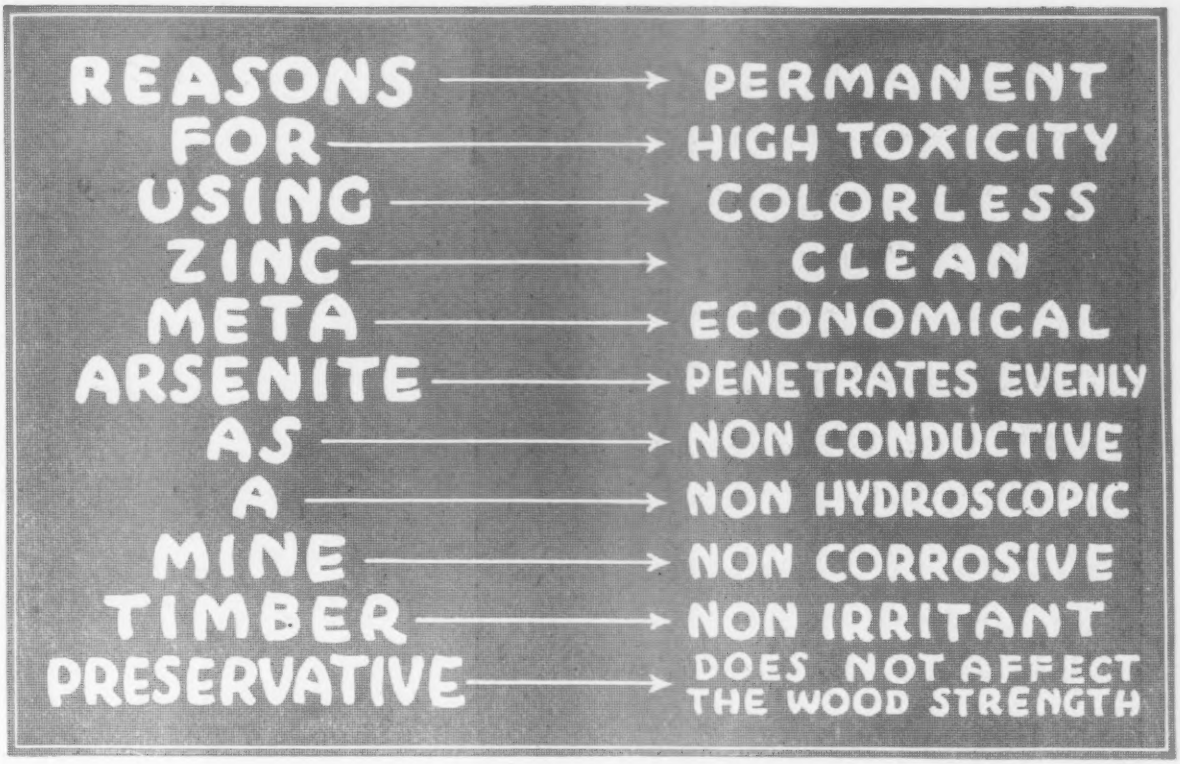
Monongahela Supply Co., Morgantown, W. Va.

This mark means Ahlberg Ground

Ahlberg *Ground Bearings*

SERVICE PROVEN

THEY MEAN A SAVING OF 40% IN BEARING REPLACEMENT



ABOVE are listed the reasons for the employment of Zinc Meta-Arsenite by one of the most modern commercial wood preserving plants in Pennsylvania. The Keystone Wood Preserving Company of Philadelphia is operated by men who are specialists in timber preservation. It is therefore noteworthy that, after extensive search and careful investigation of preserving methods, they installed additional equipment for the use of Zinc Meta-Arsenite.

Zinc Meta-Arsenite—America's Own Wood Preservative—is now being used for the treatment of poles by the Western Union Telegraph Company—and for very important reasons:

(1) It is non-conductive.
(2) It has high toxicity.
(3) It is non-corrosive.
(4) It penetrates evenly and lasts permanently.

It stands to reason that a treatment such as this, giving protection and long life to unsheltered lumber, will certainly prove doubly effective for the treatment of timber used underground.

Write The Keystone Wood Preserving Company for any advice or further particulars, or if more convenient, communicate with The Curtin-Howe Corporation direct.

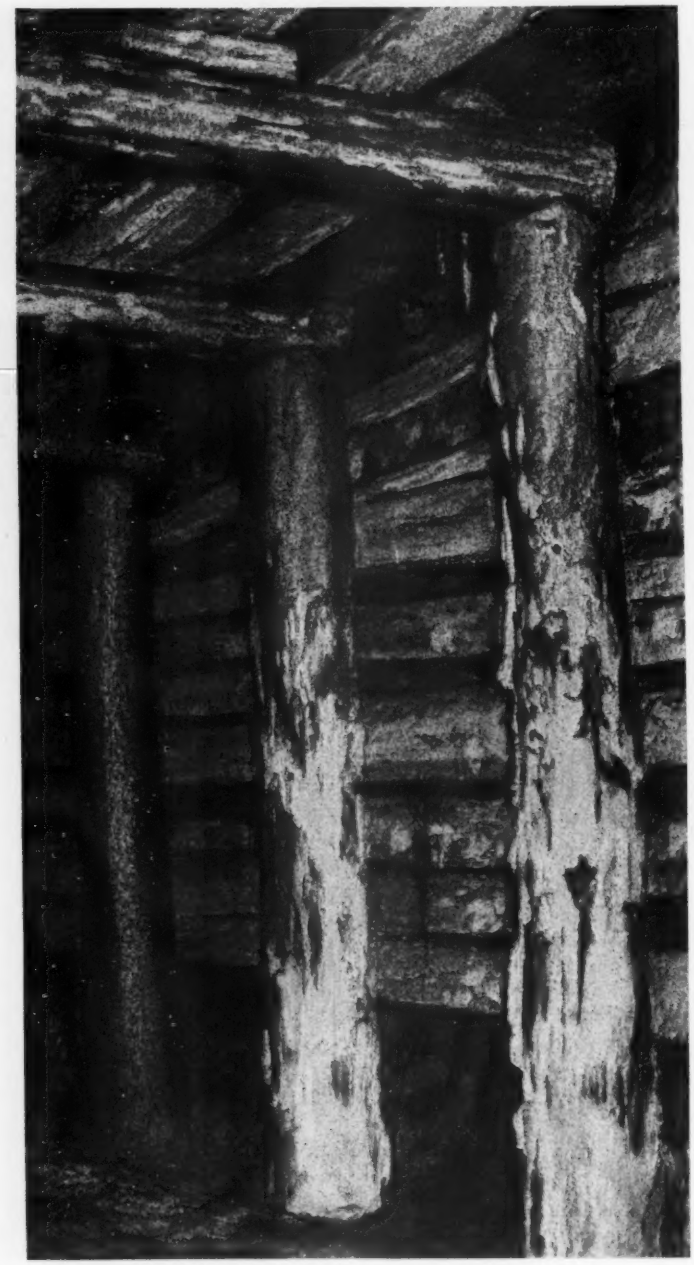
KEYSTONE WOOD PRESERVING COMPANY
K W P C
PHILADELPHIA PA.

CURTIN-HOWE CORPORATION

TIMBER PRESERVING ENGINEERS

15 PARK PLACE

NEW YORK CITY



Over 100 small inexpensive Wolmanizing plants are operating in Central Europe. *No mine has ever abandoned the Wolman process.*

The A, B, C of Timber Preservation

THE proof of the preservative is in the service of the treated timbers. In many mines in Central Europe Wolmanized timbers that have been installed for from 12 to 15 years are still in good condition. Over a million railroad ties installed in Germany in 1915 under a formal guaranty had called for no replacements in 1927. In Switzerland, Denmark, Sweden and under extreme conditions in Central America and the warm and wet Silesian mines, Wolmanized timbers are showing up to unusually good advantage.

Wolmanized timbers have high toxicity, they are clean, they are permanent, economical, dependable and fire retardant.

See our exhibit at Booth 228, Cincinnati, or send for descriptive literature.

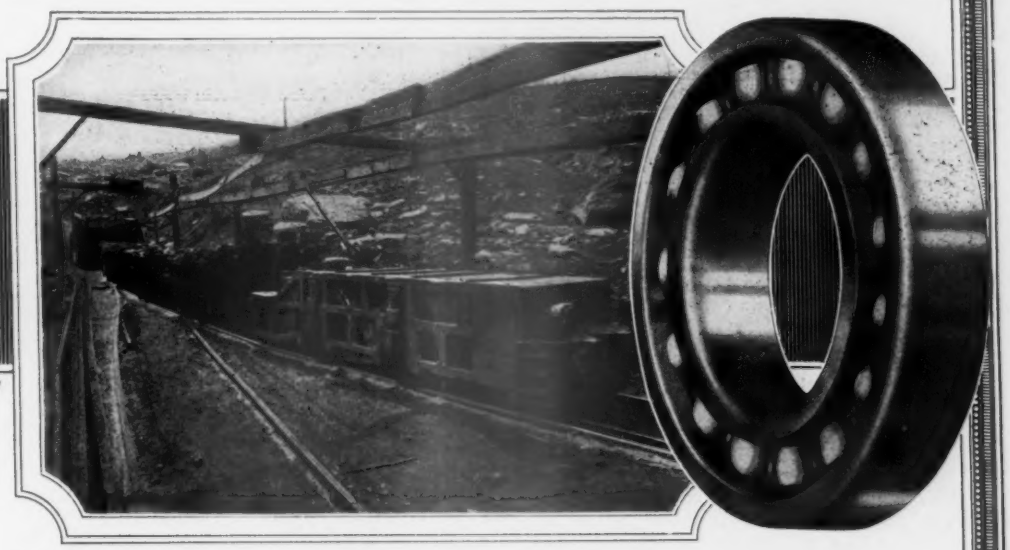
The life of timbers treated with common preservatives or with brush treatment is lengthened but the added life is frequently short.

Untreated mine timbers, where permanence is required, are frequently a menace as well as expensive.

American Wood Treating Corporation,
25 Broadway, New York

United Wood Treating Corporation
1138 Lake Shore Drive, Chicago

WOLMANIZED TIMBERS



New Departure Ball Bearings

The Better Mine Car will be Ball Bearing-equipped

ONLY in a ball bearing is starting friction as low as running friction. Only with a ball bearing can mine cars retain sufficient lubricant indefinitely in dust-excluding, oil-tight housings. New Departure Ball Bearings, because of their precision construction and enduring high carbon chrome steels, outlive even the cars themselves.

In the New Departure Exhibit at Cincinnati you will find a mine car axle and wheel mounting employing a novel and exclusive New Departure design—departing from the conventional in these four important respects:

1. Shock loads cushioned to increase bearing life.
2. Largely avoids breakage of wheel flanges.
3. Variation in track gauge no serious effect upon wheels or bearings.
4. Maintenance requirements reduced to an absolute minimum.

New Departure engineers in attendance at spaces 207-209 will be very glad to explain New Departure advantages not only in mine cars, but in all other mining machinery.

The New Departure Manufacturing Company
Bristol, Connecticut
Detroit San Francisco Chicago

MINE TRACKS, SIGNALS AND SWITCHES

(Approved by the American Engineering Standards Committee as Tentative American Standard, May 13, 1927, The American Mining Congress, sponsor.)

Foreword

1. As the standardization of trackwork can be made very definite, and as full details are necessary, the recommendations for frogs and switches are shown by 33 drawings. The drawings are numbered by hundreds and divided as follows:

Section	
No. 1—Riveted frogs	100
No. 2—Cast frogs	200
No. 3—Switches	300
No. 4—Guard rails	400
No. 5—Turnouts	500
No. 6—Switch stands	600

2. For an understanding of the drawing groups, let it be stated that Nos. 120-25, 121-25, etc., cover riveted frogs. Drawings 200-25 and 201-25 cover cast frogs, while 300-25, 301-25, etc., show switches or switch fixtures. The lone number 25 in each case signifies the drawing was made in 1925.

3. The 20 in 120 and the 21 in 121 is for No. 2 frogs as covered by the figure 2 in 120, while the figure 3 in 130 group signifies No. 3 frog, etc. For switches the first figure 3 in, say, 350-25, signifies a switch drawing, while the 5 in 50 indicates a 5-foot switch.

4. The drawing groups being now explained we pass on to the recommendations for standards.

Gage:

5. The standard track gage shall be 42 inches.

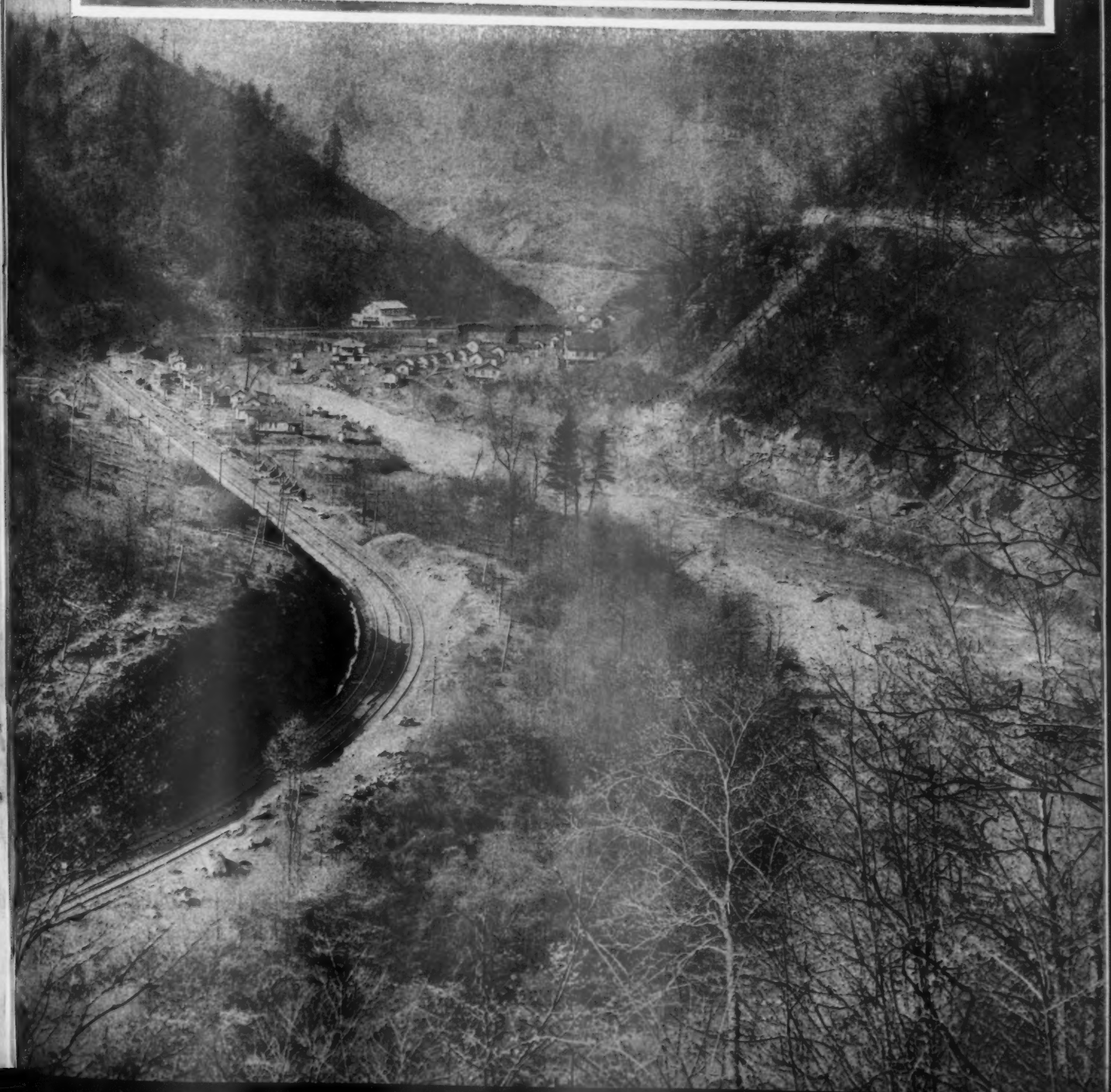
6. The adoption of this dimension is based on the fact that the number of mines actually using it is greater than any other. A 42-inch gage forms the best radii of curves with useful frog angles to suit the majority of coal-mine work.

7. Under certain conditions, such as demands the use of cars to meet low-roof mines, etc., a gage of 42 inches may be prohibitive, and if necessary that it be other than standard the alternatives shall be in steps of 6 inches above or below, such as 30, 36, or 48 inches.

8. In addition to the above an extra alternate of

THIS is the first page of the MINE TRACKS AND SIGNALS section of the Handbook of Standard and Approved American Coal Mine Practice. For a more complete outline of this book turn to page 98 in this section.

VENTILATION EQUIPMENT



BOOTH 299

CINCINNATI CONVENTION

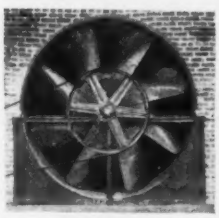
What's new? What is the most efficient equipment to use for various purposes? They are always the questions asked by the practical men of industry. These questions are answered at conventions. Then the new things in the industry—the most efficient equipment—can usually be seen at the exhibits. Booth 299 this year will be headquarters for demonstrating the new and most efficient mine ventilating equipment. Be sure to visit this exhibit which you will find right inside the door to the main entrance.

The illustration below shows Robinson Tubing Blowers. These blowers are arranged for any angle of discharge. Equipped with outlets for use with tubing.

Robinson Coniflo Disc Fan illustrated below Durable and Economical for shafts, slopes or drifts.

THE ROBINSON BOYS WILL BE THERE

As heretofore the Robinson engineers will be on the job to demonstrate their products. Mr. L. R. Robinson, M. E., author and publisher of the text-book, "Practical Mine Ventilation," will be in attendance and available for consultation on all ventilating problems pertaining to the mining industry. Be sure to look us up.



Robinson Turbine Wheel. The high efficiency and ease of maintenance of Robinson installations is due to the scientific construction of this wheel.

ROBINSON VENTILATING CO., ZELIENOPLE, PA.

ROBINSON FANS

DRAINAGE EQUIPMENT

Single stage mine pump; capacity 250 gal. per min. against 40 ft. head at 1,750 r.p.m.

De Laval single stage pump in a coal mine delivering 400 gal. per min. against 40 ft. head

Submit Your Pumping Conditions
and Place Your Order Early

THE most progressive companies follow this policy and are our best customers.

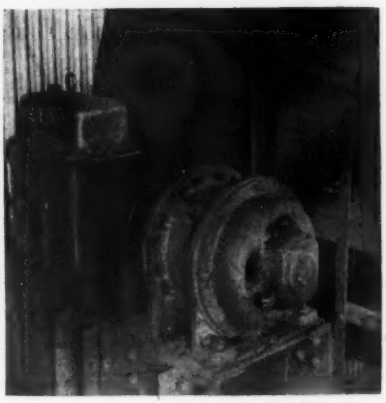
You can then obtain a De Laval pump with impellers especially designed for the job, which will save in power and maintenance expense. De Laval pumps are accurately made to limit gages and all wearing parts are renewable without requiring any fitting or machine shop work by the user.

A mine foreman recently stated, "I like De Laval Pumps because they always go together."

WORM GEAR REDUCERS FOR MINES

The strong trend in the mining industry toward enclosed, self-lubricating speed reducers has been largely made possible by the De Laval Worm Reduction Gear, which is made in one grade only—extra heavy construction with the utmost attainable accuracy.

For the many practical applications of reducers read the article on this subject in the April, 1928, issue of the Mining Congress Journal.



Write for special De Laval publications on mine pumps and speed reducers, to nearest office.

De Laval Steam Turbine Co., Trenton, N. J.

DRAVO-DOYLE COMPANY
300 Penn Ave. Pittsburgh, Pa.
4800 Prospect Av. Cleveland, Ohio
15th and Race Sts. Philadelphia, Pa.

BURFORD, HALL & SMITH
Red Rock Bldg., Atlanta, Ga.
TURBINE EQUIPMENT CO.
30 Church St., New York City
SALT LAKE HARDWARE CO.
Salt Lake City, Utah

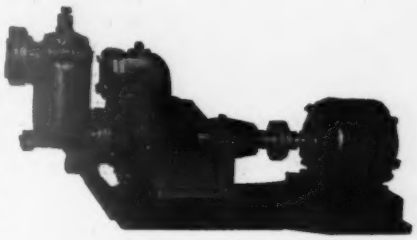
DE LAVAL STEAM TURBINE CO.
1108 Peoples Gas Bldg. Chicago, Ill.
Rialto Bldg. San Francisco, Calif.

744

easy to keep the floor dry

A small hole drilled at the working face at the time the shot holes are drilled is all the preparation necessary for the efficient combination of the LaBour Automatic Gathering Valve and the LaBour Centrifugal Mine Pump. Into this hole this small gathering valve is dropped. The pump and valve do the rest automatically. Working conditions are improved, and electrical Equipment is both protected and kept in service.

LaBour Centrifugal Pumps are automatic, create a positive suction without the use of valves, they actually pump air. They remain primed at all times. They are made in a variety of sizes for low head work and a choice is available of motor, belt, or gasoline engine drive. Write for a descriptive circular of these mechanically simple, acid resisting and highly efficient mine pumps.



Drill a small hole in the floor and drop into it the small LaBour Gathering Valve and your working face can be kept constantly dry—these valves will work from a number of working places at different elevations. It is automatic and continuously regulates the flow of water to the pump, closing when the water is low and preventing return flow. Used with the LaBour Centrifugal Mine Pump it automatically answers the where, when, why, and how of dry working places.

ELCOMET is a strong ductile metal highly resistant to acids. This metal has recently been further developed. We believe that now it is hard to surpass the combination of this metal and the efficiently designed LaBour Pumps.

and now

ELCOMET

SEND FOR CIRCULARS AND SEE US IN CINCINNATI

THE LABOUR COMPANY

CHICAGO HEIGHTS, ILLINOIS

MINE DRAINAGE

(Approved by the American Engineering Standards Committee as Tentative American Standard, June 2, 1927, American Mining Congress, sponsor.)

PUMPS FOR DEVELOPMENT WORK

(A)

Pumps for development work are needed during the opening of a new mine or for the extension of entries or headings, etc., in an operating mine.

(B) Location.

Pumps are needed to remove water from rooms, headings, slopes, shafts, etc., where an accumulation would interfere with the successful development of the mine and removal of coal. These pumps should be located in a temporary place as near as possible to the water accumulation, but away from the haulage roads and working places, so as to not interfere with the mining operation. Wherever possible, pumps should be so placed in relation to the body of water to be pumped that a shutdown for a reasonable period of time will not place the apparatus in danger of being drowned out nor handicap the workmen making repairs.

(C) Construction of Station.

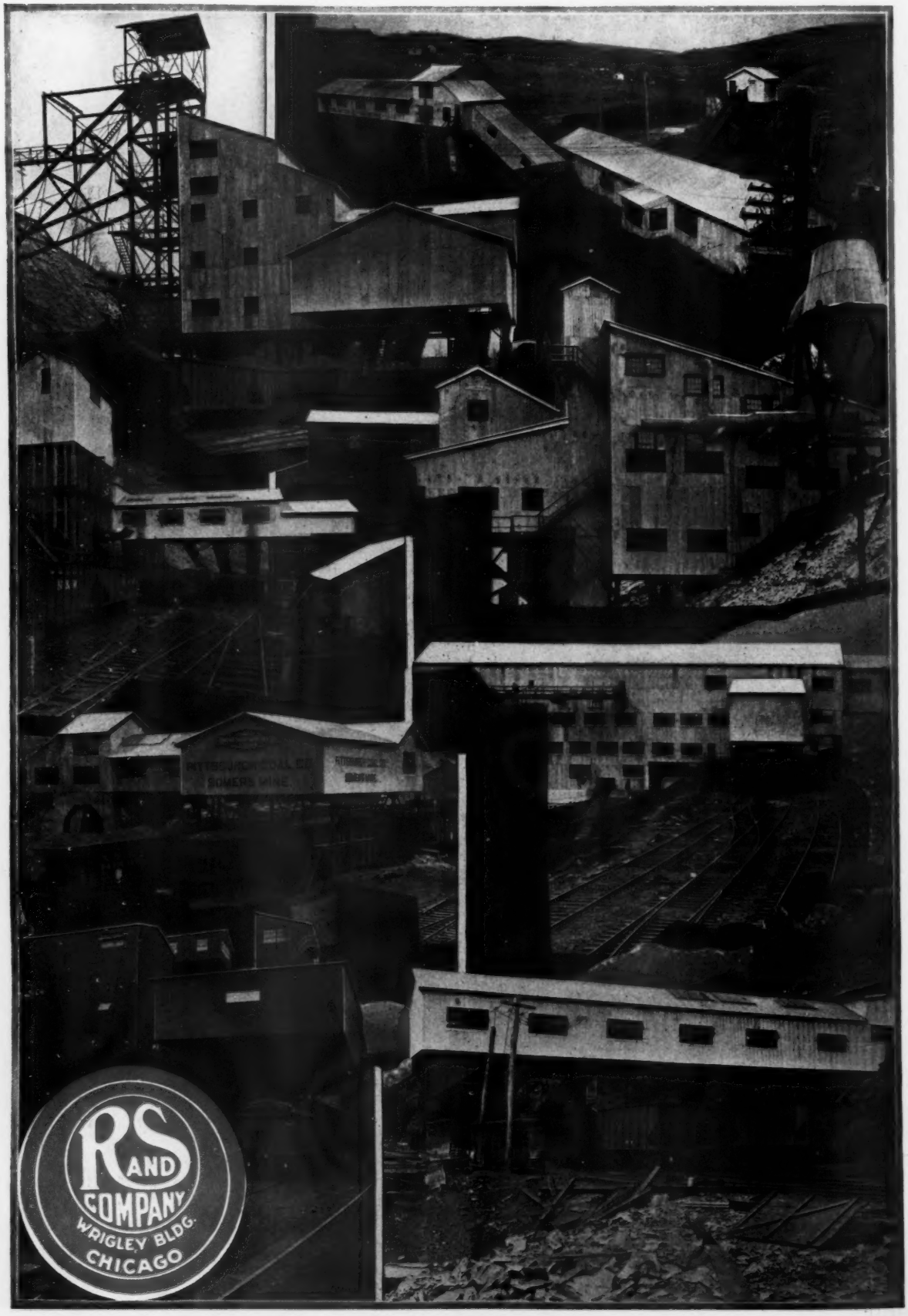
Pump installations for development work are of a temporary character and installations should be made accordingly. The pumps should be so located as to be easily accessible for repairs and oiling, etc., and so located that the attendant can move about the pump freely without coming in contact with any moving parts. Pumps should be so located that the main current of air does not pass over and around them, and in all cases the pumps should be on the intake air current and not on the return air current.

(D) Sumps.

Large sump capacity is not generally practical during development work, as considerable of the water is gathered in small quantities from numerous working places.

THIS is the first page of the MINE DRAINAGE section of the Handbook of Standard and Approved American Coal Mine Practice. For a more complete outline of this book turn to page 98 of this section.

COAL PREPARATION


RS AND COMPANY
WRIGLEY BLDG.
CHICAGO

AS THE time for another coal convention draws nigh, we are wont to pause a moment and review the progress of the industry and the part we have played during the past twelve months toward the improvements of modern methods, mechanical efficiency and lower production costs.

This past year has seen the adoption as standard of the Menzies Hydro Separator for cleaning large sizes of bituminous coal.

It has witnessed the broader use of Arms Concentrating Tables for cleaning fine sizes of coal and the unusual acceptance accorded this RandS Unit.

Again the trend of opinion among a majority of operators swings toward RandS Equipment when RandS Car Dumpers are selected for 95 per cent of all the installations made during the year.

Arms Vibrating Screens, too, have received their share of popular favor, as have the new Marcus Drive Heads, and the many other plant units we have perfected and presented to the industry.

We are appreciative of the faith shown our equipment and our services, and are proud to point to the many successful tipples we have designed and erected—a list too numerous to mention here, but represented by installations at Berwind White Coal Mining Co., Windber, Pa.; Pittsburgh Coal Company, Pittsburgh, Pa.; Hillman Coal and Coke Company, Pittsburgh, Pa.; Pittsburgh Terminal Coal Corp., Pittsburgh, Pa.; Crozer Coal and Coke Company, Elkhorn, W. Va.; Algoma Coal and Coke Company, Algoma, W. Va.; Ohio Collieries Company, Toledo, Ohio.

We repeat we are proud of these accomplishments and the rewards bestowed upon us for keeping faith with our industry.

So that you may see RandS Equipment in actual operation, we will display Arms Vibrating Screens and the Menzies Hydro Separator at the Coal Convention, May 7-11. Further, our engineering department staff will be available to you for detailed information on our complete service to coal mine, tipple and washery operators.

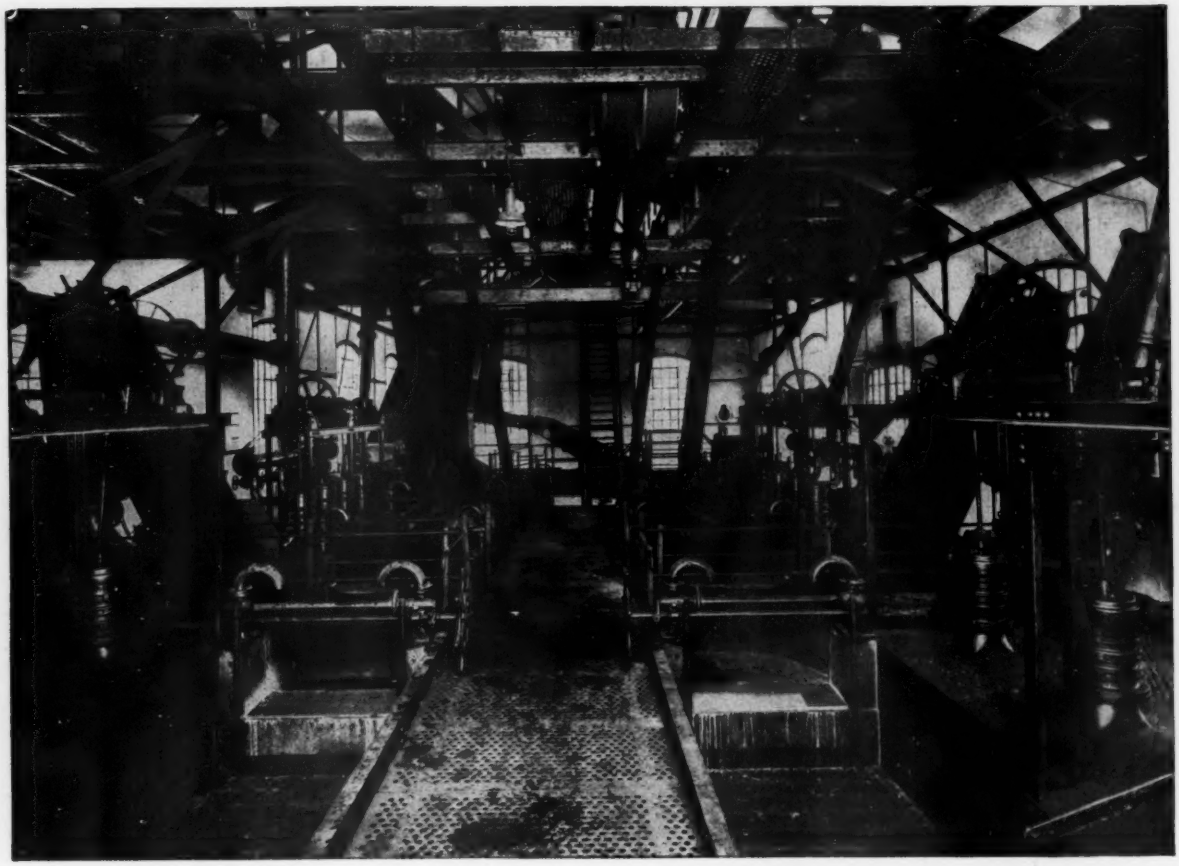
ROBERTS AND SCHAEFER CO.

PITTSBURGH, PA. 418 Oliver Bldg.

ENGINEERS AND CONTRACTORS WRIGLEY BLDG. ··· ··· CHICAGO

HUNTINGTON, W. VA. 514 9th Ave.

RS AND COMPANY WRIGLEY BLDG. CHICAGO



You'll get larger profits and less

TOP—A Link-Belt–Simon-Carves double unit re-washer. Capacity 200 tons per hour.

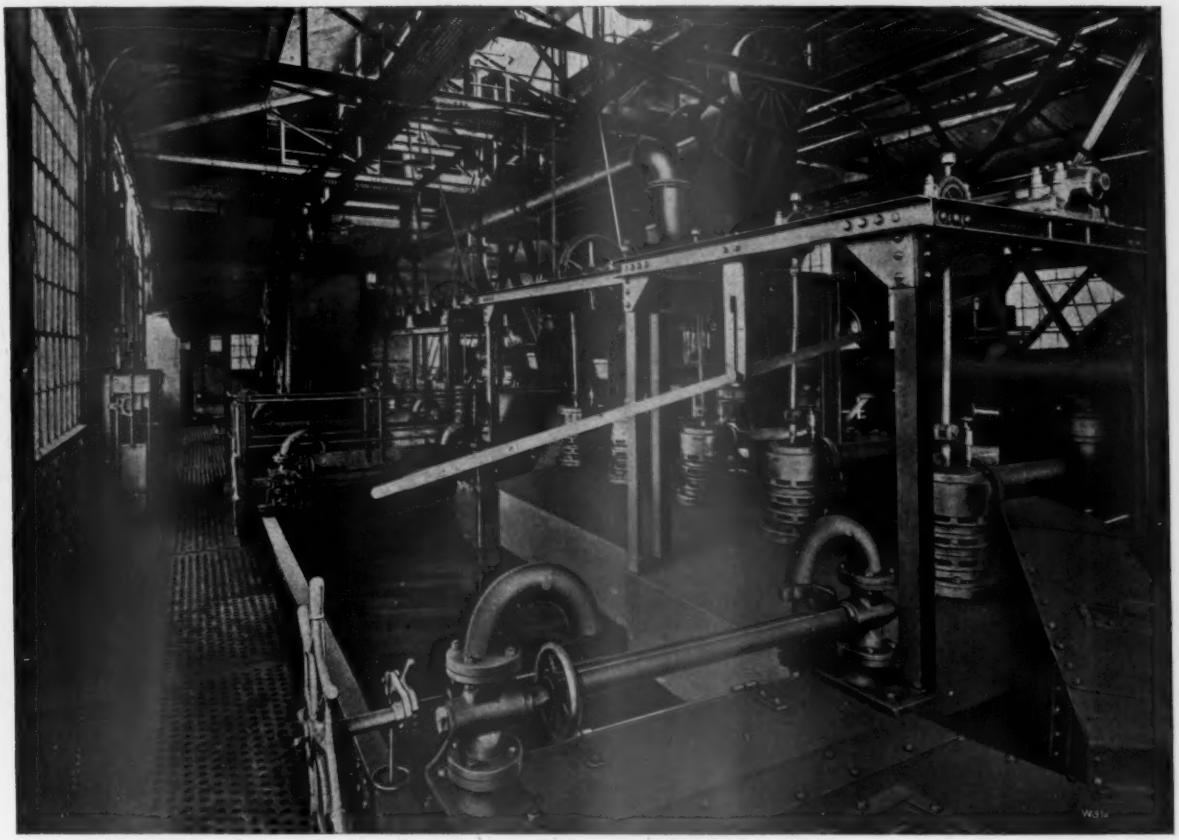
ABOVE—A washery of 100 tons per hour capacity built by Simon-Carves, Ltd.

EVEN in the worst periods of market depression coal with a reputation for being "clean" finds a ready market.

Of equal importance to proper cleaning and thorough preparation is the subject of "cost"— Link-Belt — Simon-Carves Washeries are cheaper to operate than any other type of Washery—the care exercised in design—often makes them the lowest in first cost.

LINK-BELT COMPANY

LINK-BELT
SIMON-CARVES WASHERIES



sales resistance from clean coal

Orders recently placed will enable us, in the very near future, to show results from American installations.

Until such time as this is possible, you will find the literature which we have issued, most interesting. Your inquiry addressed direct to Link-Belt Company, 300 W. Pershing Road, Chicago, Illinois, will receive prompt attention.

300 WEST PERSHING ROAD, CHICAGO

TOP—Interior view of typical Link-Belt–Simon-Carves Washery.
ABOVE—A Simon-Carves Washery, near Pontefract, England.

3400

LINK-BELT
SIMON-CARVES WASHERIES

PROGRESS EFFICIENCY

American Pneumatic Coal CLEANING PROCESS

PROVES

coal-producing

22 Plants

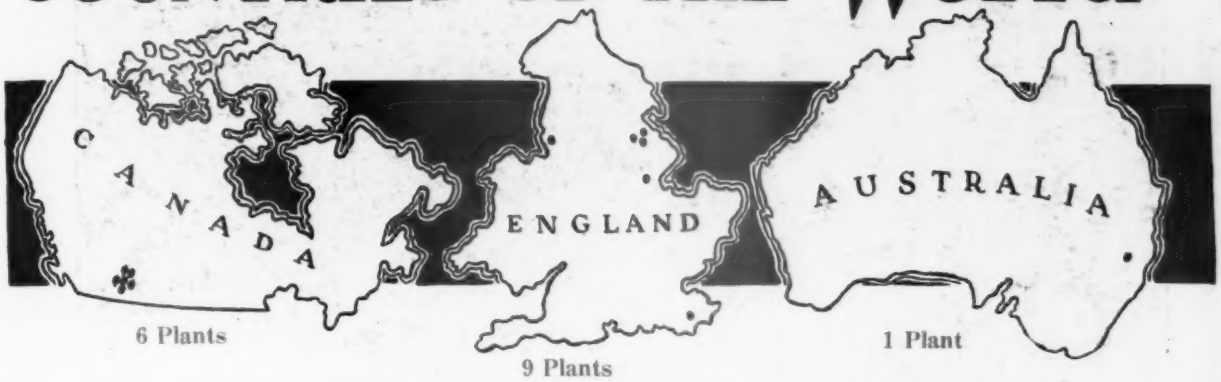
Increasingly keen competition is forcing the coal industry to greater efficiency. Methods approved yesterday and tolerated today are being discarded. Efficiency must triumph. This is the inevitable logic of economics.

EVERY coal producer is facing the problem of mining and preparing his coal at a lower total cost. He also must have a cleaner and better product to successfully meet competition and the demands of today's markets.

The superior advantages of the AMERICAN Pneumatic Process of cleaning coal DRY are definite and have been fully proved over a period of years. Twenty-two AMERICAN plants are now operating in the United States. Six in Canada. Nine in England. One in Australia.

More than TWELVE MILLION TONS of coal are being cleaned annually on AMERICANS and this tonnage will be tremendously increased in 1928, as new plants come into operation.

ADVANTAGES *in* Great COUNTRIES OF THE *World*



Coal cleaned by the DRY process—WITHOUT ADDING MOISTURE—is an economical advantage to the producer and consumer alike. Returns are greater, markets are broadened, demand increased, mining operations are stabilized and operating and overhead costs reduced on account of steady operation. Compare the operation record of mines so equipped with that of those using other methods.

A superior fuel is delivered the consumer with its consequent saving in freight and handling charges, plant investment, uniformity of operation and the production of a superior and more uniform finished product.

The AMERICAN Pneumatic Coal Separating Process removes the free impurity from the coal. It does not substitute one form of impurity or inert matter for another—MOISTURE IS NOT ADDED.

PNEUMATIC COAL SEPARATION RECORD
INSTALLED CAPACITY

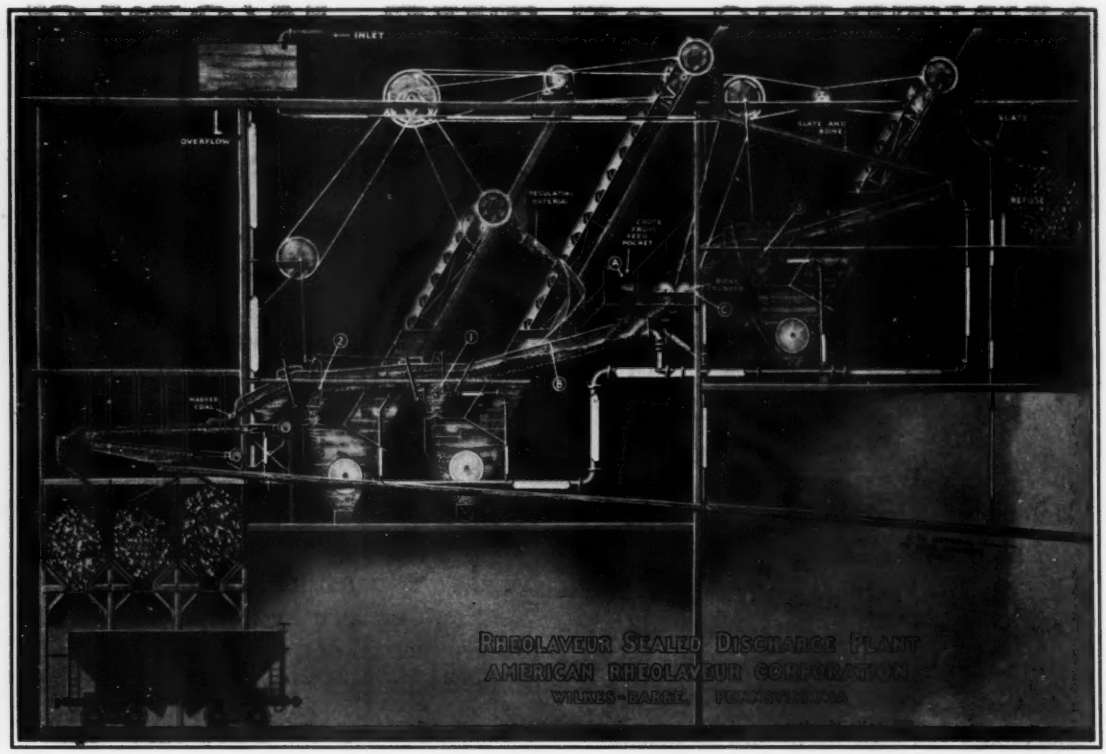
December 31st, 1925	9 Plants	1,776,000 Tons
December 31st, 1926	17 Plants	4,560,000 Tons
December 31st, 1927	31 Plants	9,744,000 Tons
April 15th, 1928	38 Plants	12,000,000 Tons

AMERICAN

COAL CLEANING CORPORATION

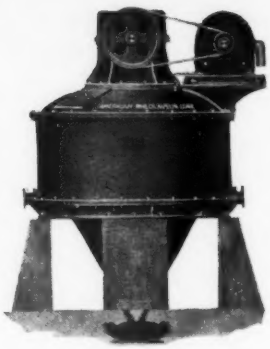
WELCH, W. VA.

See the Rheolaveur



20% Moisture reduced under 5% with the

CARPENTER CENTRIFUGAL DRIER



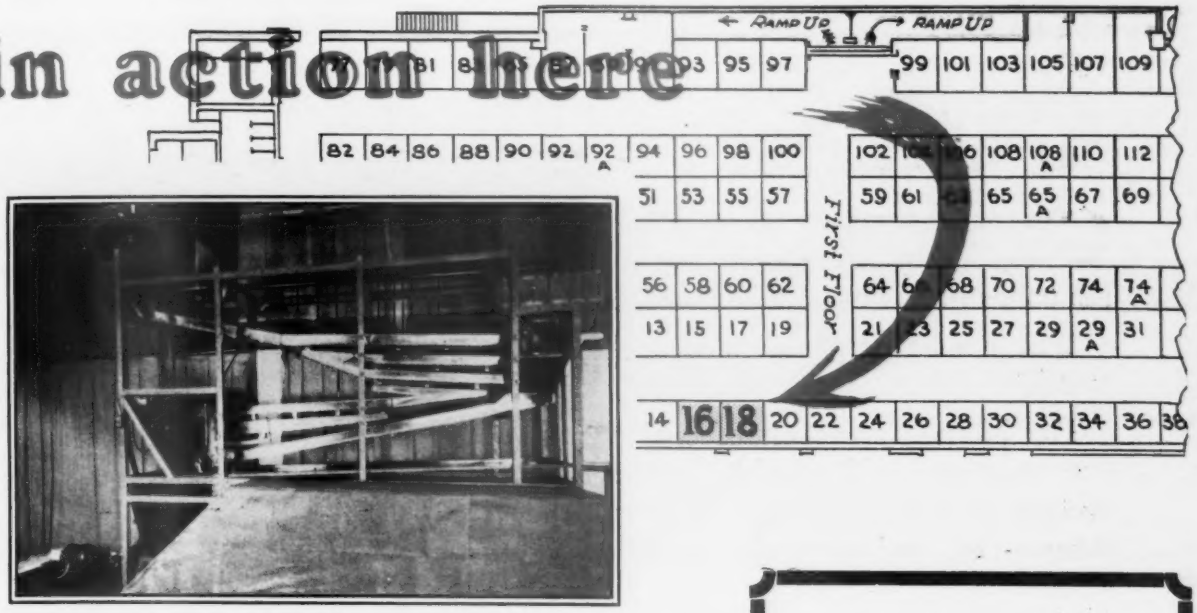
At a cost of only a few cents per ton dried, the Carpenter Centrifugal Drier reduces moisture from 20% to between 3 and 5% depending upon the size of coal. Minus ¾" coal handled efficiently and economically.

Carpenter Driers are self-contained units—two sizes give a capacity range from 25 to 100 tons per hour.

Among the new plants under construction to be equipped with Carpenter Driers is the Champion Washery (Rheolaveur Process) of the Pittsburgh Coal Co.

Full particulars at Booths 16 and 18, American Mining Congress Exposition, or by return mail.

in action here



TO see the Rheolaveur in operation and learn how it is meeting a great variety of coal washing problems, stop at Booths 16 and 18, American Mining Congress Exposition, Cincinnati, May 7th to 11th.

When you see it in action you will understand why—

It has been installed by such outstanding companies as American Smelting & Refining Co.; Glen Alden Coal Co.; Hudson Coal Co.; Lehigh Valley Coal Co.; Pacific Coast Coal Co., and Pittsburgh Coal Co.

Installations in operation and under construction have total annual capacity of ten million tons and range from 25 to 800 tons per hour capacity.

Simple and inexpensive installations can be designed for those coals which are easily cleaned. Where cleaning presents a difficult problem, Rheolaveur can be elaborated to produce almost perfect results with only a slight increase in first cost of plant.

These minature operating plants will demonstrate what Rheolaveur will do for YOU.

You can also get the news on the latest accomplishments of the Carpenter Drier and the Non-Blind Wedge Wire Dewatering Screen.

If you are not at the Exposition, write for latest bulletins.

6 Chief Advantages

1. **Increased yield of marketable coal with greater proportion of large sizes.**
2. **Low installation and operating costs.**
3. **High recovery with maximum refuse removal.**
4. **Dependable operation with definite control.**
5. **Feed with high and variable refuse content efficiency washed.**
6. **Make-up water requirements very low.**

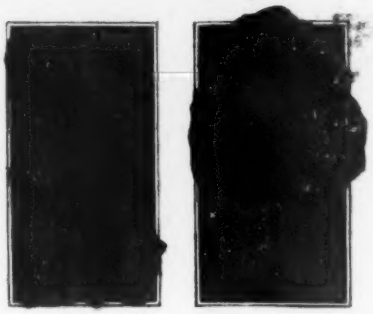
AMERICAN RHEOLAVEUR CORPORATION

911 Coal Exchange Bldg., Wilkes-Barre, Pa.

120 Broadway, New York City

P. O. Box 486, Scottdale, Pa.

CLEANER COAL



COAL consumers are demanding cleaner coal—they are specifying a definite ash content that must not be exceeded.

Why not be prepared to meet these demands?

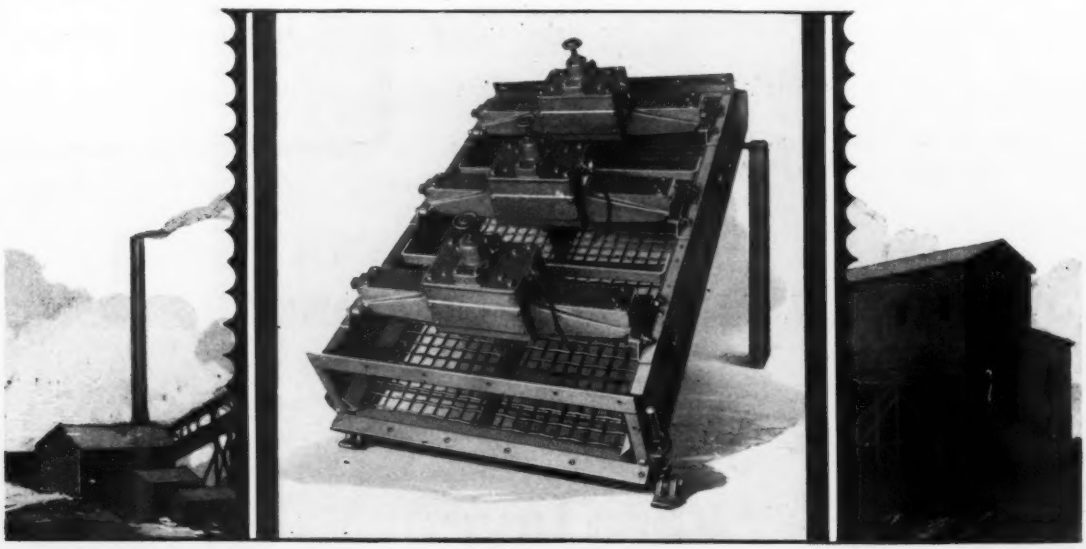
The Hum-mer process of coal preparation combined with efficient coal-cleaning equipment, will enable you to produce far cleaner coal and to materially reduce the percent of ash — WITH LESS LABOR AND AT LOW COST PER TON!

Success in the coal industry depends upon efficient coal preparation. Let us show you the profitable results many producers have obtained with the Hum-mer process.

Send for Catalog 52-Y on "Screening for Profit."

THE W. S. TYLER CO., *Cleveland, Ohio, U. S. A.*

Manufacturers of **Woven Wire Screens and Screening Equipment**



HUM-MER *Electric* SCREEN

CLEAN COAL AT LOW COST

THE SAND FLOTATION PROCESS

Produces Clean Coal by Removing intermixed Slate and Rock
THOROUGHLY, CHEAPLY AND UNIFORMLY

It reproduces the results obtained by laboratory Float and Sink tests being a true Float and Sink process on a Commercial scale.

It will float for crushing and retreatment laminated coal and bone of any specific gravity from 1.40 up to 2.20 or higher if desired.

It cleans all sizes from five (5) or six (6) inches in diameter down to 1-16th inch or 3-64ths inch round hole.

It cleans the heaviest anthracite and the lightest bituminous coal producing uniformly high grade shipping products.

LARGE CAPACITY - LOW FIRST COST

Machines now in use can take material six inches in diameter.
Machines can be built to take any desired larger size.

IT IS THE ONLY SAND FLOTATION PROCESS IN USE.

While its present use is confined to cleaning coal
THE PROCESS CAN BE USED TO FLOAT AND REMOVE
the Heaviest Gangue Minerals and Middlings in
CONCENTRATING METALLIC ORES

COAL CLEANING & EQUIPMENT CORP.
260 SO. BROAD ST., PHILADELPHIA, PA.
BITUMINOUS LICENSORS IN PENNSYLVANIA, OHIO, AND MARYLAND

LICENSORS FOR OTHER DISTRICTS
H. M. CHANCE & CO.
843 DREXEL BUILDING
PHILADELPHIA, PA.

H. O. STAPLES
SOLE ANTHRACITE LICENSOR
M. A. WALKER, General Manager
MEARS BUILDING, SCRANTON, PA.

PEALE-DAVIS "PNEUMO-GRAVITY" SYSTEM DRY WASHERIES

One of the Peale-Davis Plants of 200 to 250 tons per hour capacity installed in Central Penna.

THE Peale-Davis "Pneumo-gravity" System, as the name implies, is a dry process for the removal of impurities from coal and other like material. Five plants have been in practical operation since 1923, when the first plant was installed for the PEALE INTERESTS at St. Benedict, Penna. The first European plant is now being built by our British Licensee and nearing completion in England.

This System we believe to be superior to and is distinctive from any dry process on the market in that it *"dry washes" all sizes of coal from 3 inches down to dust simultaneously on one table without the added machinery, expense and labor of making preliminary and diversified sizes,* and because of the large capacity per table. The *primary table treats from 50 to 300 tons per hour,* and the accompanying retreatment table treats from 30 to 90 tons per hour, dependent upon the respective designs. Thus, it minimizes the cost of installation, upkeep and horse-power required to operate a multiplicity of sizing screens and individual tables and, likewise, by using a simple device, *a dust chamber of increasing area, it precludes the necessity of installing the usual expensive mechanical dust collecting system.* As in any process, there is likely to be some loss of coal with the refuse, another advantage of the Peale-Davis System is the utilization of a retreatment table, by which we have been able to solve this problem and retain such coal. We believe that ours is the only dry process which is able to present this feature, because of the fact that we, similarly, are able to treat all of the refuse (3 inches maximum down), from the Primary Table on a single Retreatment Table.

Figures from going plants indicate that the total cost per ton for operation of 100-ton per hour plant, covering *power, labor, repairs* and *labor cost repairs* is only .027537 *cents per ton.*

OUTSTANDING ADVANTAGES
of Peale-Davis System

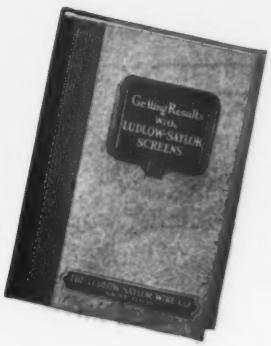
1. "Dry Washing" *without pre-sizing.*
2. Primary Unit of large capacity.
3. Secondary or Retreatment Unit minimizing coal loss.
4. Small floor space, resulting in low cost of plant construction.
5. Dust collecting system *without the use of mechanical means,* which successfully controls dust laden air and prevents escape of dust into the interior of building or atmosphere.
6. Low Maintenance Cost.
7. Low Labor Cost.
8. Low Power Cost.

Testing plant and Engineering Offices located at St. Benedict, Penna.

PENNSYLVANIA MINING MACHINERY CORP.
ST. BENEDICT, PENNA.

2007 GRAYBAR BUILDING (GRAND CENTRAL TERMINAL) NEW YORK, N. Y.

Wherever your market lies, "Perfect" Preparation on Woven Screens reflects in both the product and the price



"Getting Results with Ludlow-Saylor Screens" is a 200-page summary of America's latest achievements in screening practice.

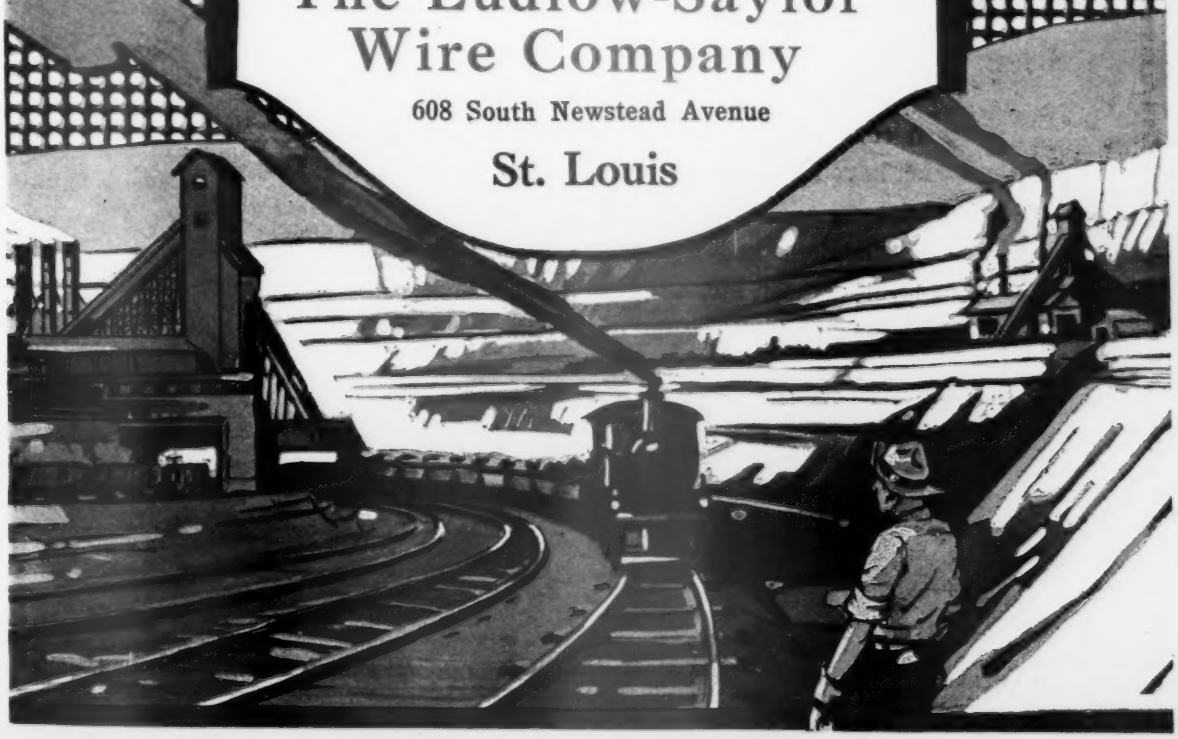
A copy will be sent free upon request to any reader of

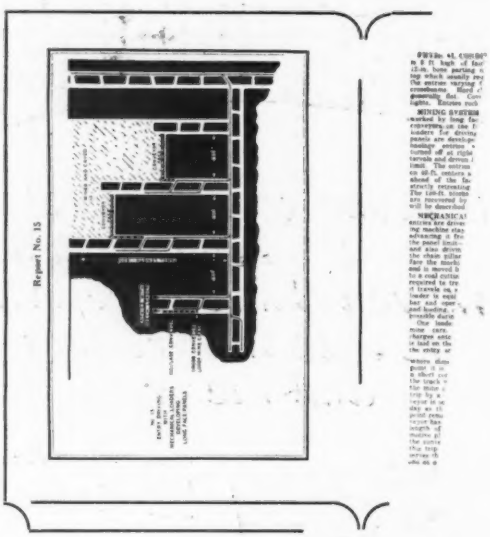
The Mining Congress Journal

The Ludlow-Saylor Wire Company

608 South Newstead Avenue

St. Louis





THE Yearbook on Mechanized Mining has just been published. It includes:

A survey of the progress of mechanized mining in the coal industry, based upon fifteen months' investigation conducted by G. B. Southward for the American Mining Congress.

A comprehensive study and survey of the possibilities of applying mechanical mining in the various coal fields of the United States.

A complete set of the reports on actual mining operations which have appeared for the past year in the Mining Congress Journal.

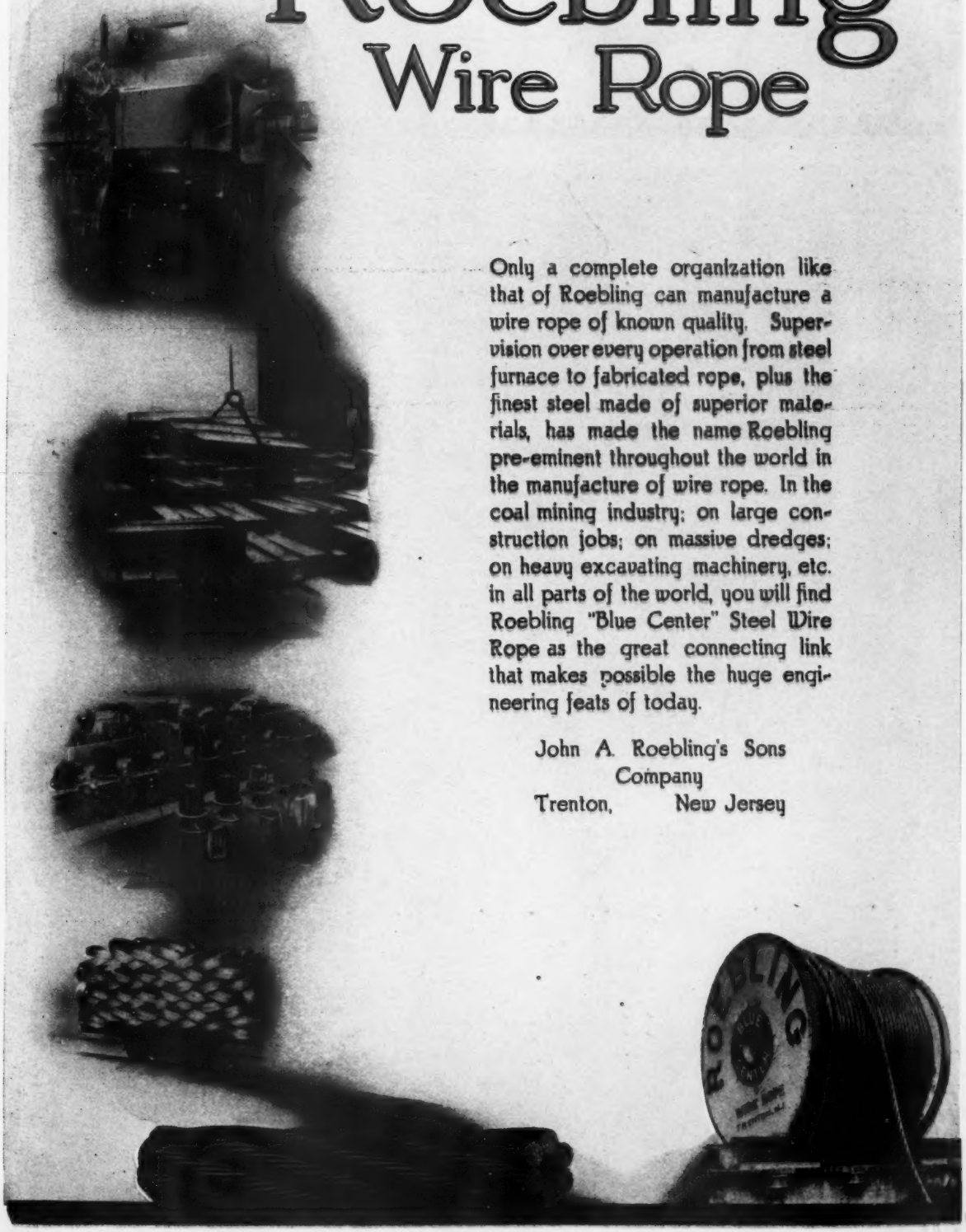
Illustrations and specifications for each loading machine, conveyor, scraper, etc.

A complete bibliography on mechanized mining.

The books, nicely bound in convenient size, sell at $3.00 per single volume—$2.50 per volume when purchased in quantities of five or more. See them at Cincinnati.

COAL HANDLING EQUIPMENT

Roebling
Wire Rope



Only a complete organization like that of Roebling can manufacture a wire rope of known quality. Supervision over every operation from steel furnace to fabricated rope, plus the finest steel made of superior materials, has made the name Roebling pre-eminent throughout the world in the manufacture of wire rope. In the coal mining industry; on large construction jobs; on massive dredges; on heavy excavating machinery, etc. in all parts of the world, you will find Roebling "Blue Center" Steel Wire Rope as the great connecting link that makes possible the huge engineering feats of today.

John A. Roebling's Sons Company
Trenton, New Jersey

"HERCULES" RED-STRAND
REG. U.S. PAT. OFF
WIRE ROPE

Let Results Be Your Buying Basis

As the proof of the pudding is in the eating, so is the proof of wire rope in its performance, and it is on this basis that we ask your consideration of "HERCULES" (Red-Strand) Wire Rope.

If you want a big dollar's worth of wire rope service for each wire rope dollar that you spend, we would like to have you give "HERCULES" (Red-Strand) Wire Rope a chance to show you what it can do.. We recommend it especially for use on cranes, shaft hoists, inclines, mining machines and shovels.

There are many reasons for its sturdiness, one of which is that it is made of acid open-hearth steel wire; another reason is that every wire is rigidly tested by us to make sure that our exacting requirements are met in every detail.

"HERCULES" (Red-Strand) Wire Rope is made in both Round Strand and Patent Flattened Strand constructions in order to meet all working conditions. If you will tell us how you use wire rope we shall be glad to recommend the construction we consider best for your work.

Transportation Problems? If you are interested in the economical handling of coal, ore, or mine waste, write for our Catalog No. T-25. It describes our various systems of Aerial Wire Rope Tramways and illustrates many installations that are now in use.

We would appreciate a visit from you at our Booth No. 47
American Mining Congress, Cincinnati

Made Only by **A. Leschen & Sons Rope Co.** *Established 1857*

Makers of
High Grade Wire Rope for All Purposes
—and—
Aerial Wire Rope Tramways

5909 Kennerly Avenue
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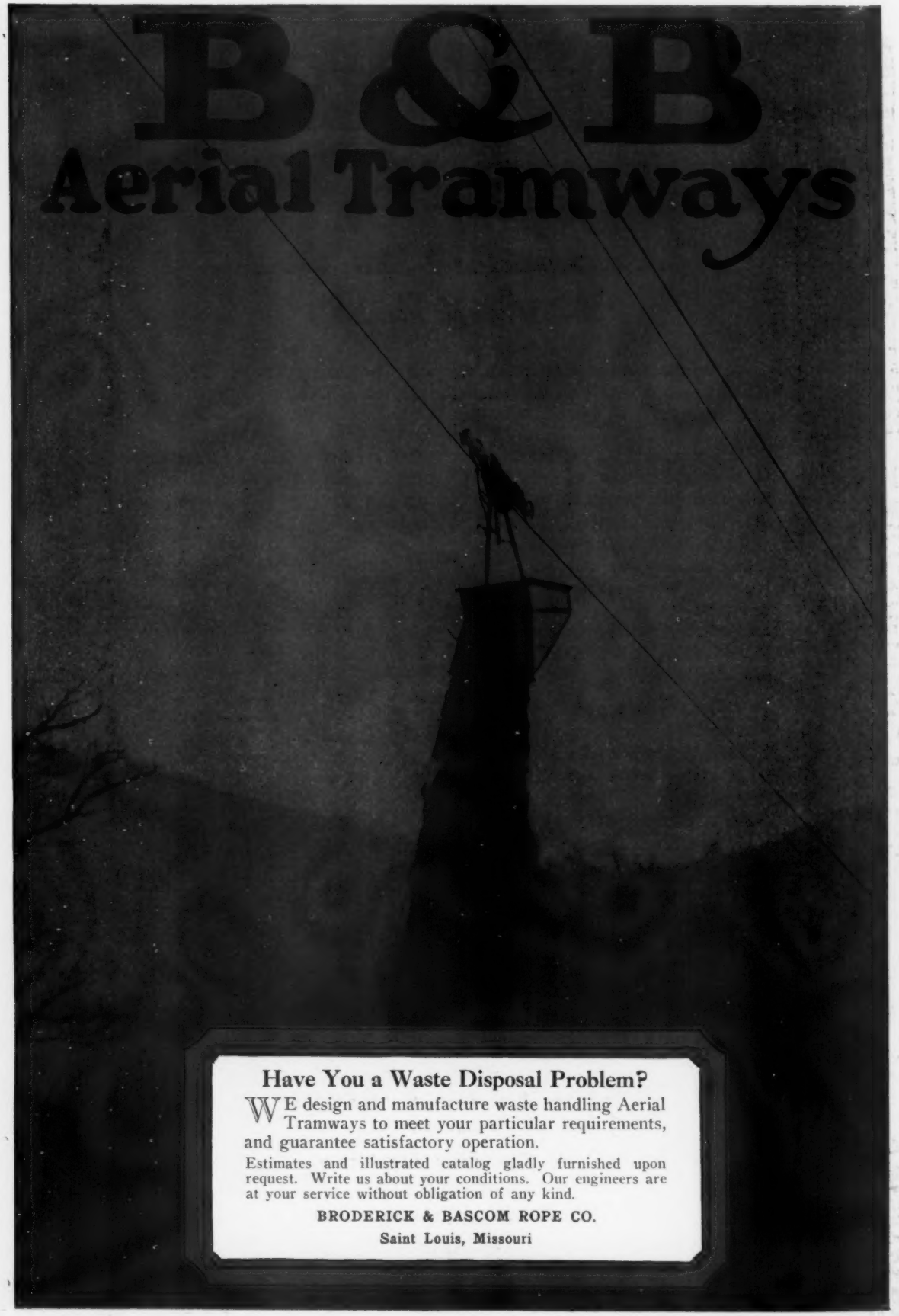

B & B
Aerial Tramways
Have You a Waste Disposal Problem?
WE design and manufacture waste handling Aerial Tramways to meet your particular requirements, and guarantee satisfactory operation.
Estimates and illustrated catalog gladly furnished upon request. Write us about your conditions. Our engineers are at your service without obligation of any kind.
BRODERICK & BASCOM ROPE CO.
Saint Louis, Missouri

Taking a foul blow from a lump of coal

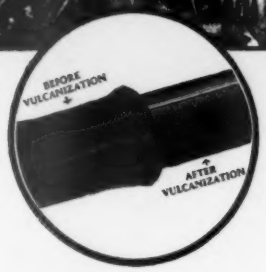
The punishment that a length of Super Service will take is remarkable. You can yank it across sharp coal faces, drag it through muck and mine waters, jerk it about from place to place, and it keeps on delivering the current. Lumps of coal, pieces of rock, can fall on it without damage to the conductors.

Toughness, tensile strength, resistance to abrasion—these qualities are built into every foot of Super Service. For every foot is vulcanized, in steel molds, under tons of pressure,— compressing the outer jacket of rubber into a dense, but flexible, layer of protection.

This is the kind of cable that expensive mining machinery needs. Cable that will keep that machinery running every hour — and showing a profit.

If you've never tried Super Service we suggest that you get a length today and let it prove its worth.

ROME WIRE COMPANY
DIVISION of GENERAL CABLE CORPORATION
Rome, New York



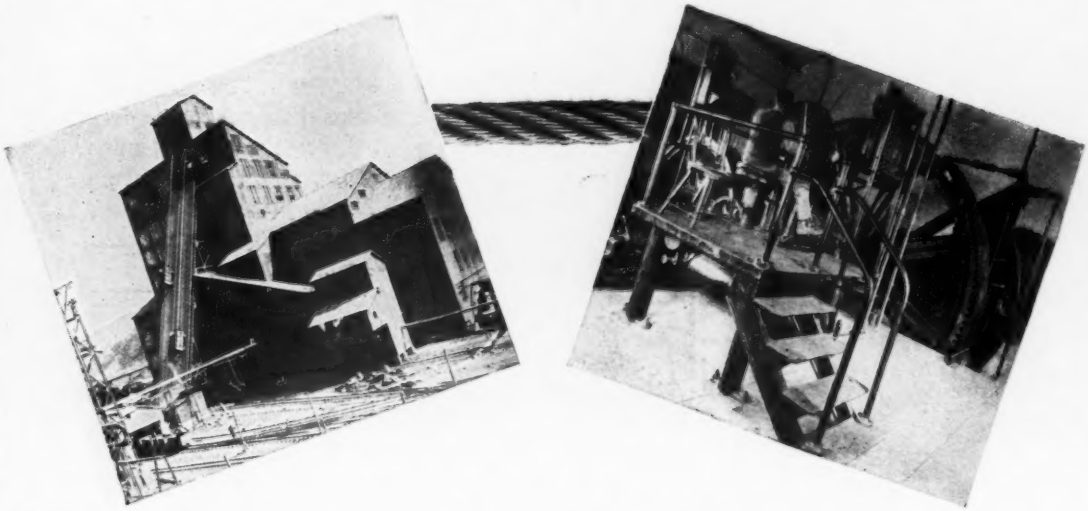
SUPER SERVICE
CORDS and CABLES
Note how the vulcanizing condenses and toughens the rubber jacket.

ROME WIRE

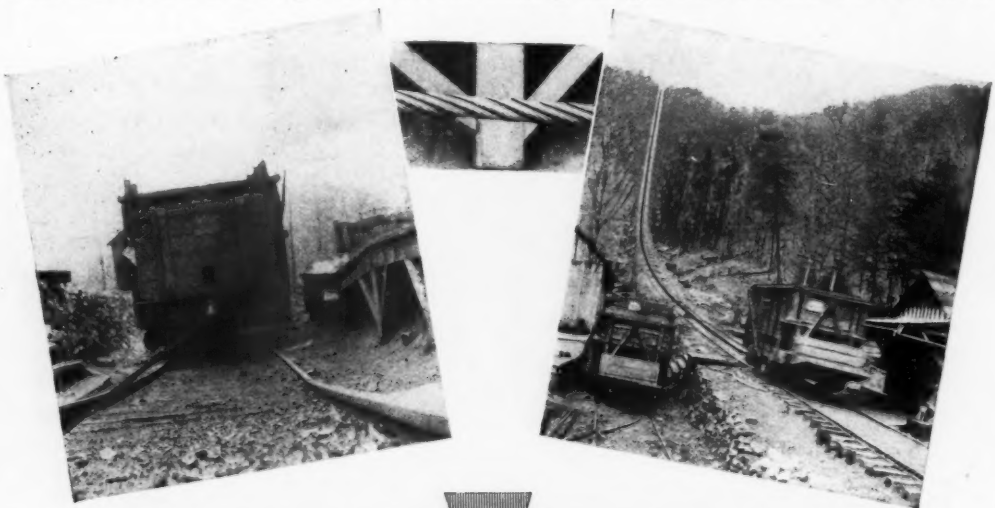
2813

FROM WIRE BAR TO FINISHED COPPER WIRE

HAZARD WIRE ROPE



HAZARD WIRE ROPE is the result of 80 years Specialization in Haulage and Hoisting Ropes for Mine Service



HAZARD WIRE ROPE COMPANY
WILKES-BARRE PENNSYLVANIA

BRANCHES and WAREHOUSES

New York	Philadelphia	Chicago	Denver
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on the bumper

Automatic Bumper-Stop Feeder

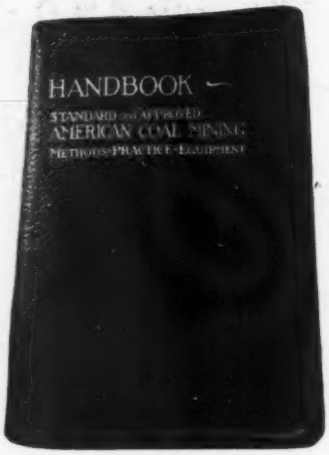
One of the
NOLAN
Automatic Feeding Systems

THE one part of a car *made* to withstand bumps is the bumper. The new bumper-stop feeder—specially designed for heavy duty—catches the car on the bumper. This allows handling of long and heavy trips without injury to cars—even where axles are weak. Heavy grades need not be changed. All brakes may be loosened at once. Safe and speedy—either automatic or hand operated. It is already in successful use at shaft bottoms; with cradle, rotary, crossover and kick-back dumps; and at the head of inclines. Built to suit any car.

Let us send you detailed description of its safe construction and positive operation. Better still, see it in Booth 287 at Cincinnati, May 7-11.

THE MINING SAFETY DEVICE CO.

Bowerston, Ohio



THE Handbook of Standard and Approved American Coal Mining Practice is the result of seven years intensive and unselfish research on the part of three hundred and fifty thoroughly representative operators, engineers and manufacturers. It is condensed and authoritative. It is cooperatively backed by the leading engineers and mining equipment manufacturers of the country.

Its recommendations are presented in practical working form and are kept up to date as new ones are approved. This work is a textbook of progress in coal mining practice. It is supplemented by the discussions in The Mining Congress Journal. Its use is a paying investment.

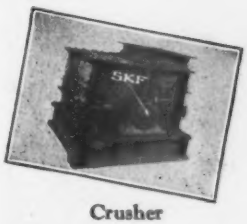
Important subjects treated in it include: basic rules safeguarding electricity in mines; electric tipple equipment; underground stations (all phases of automatic control of mine equipment); trolley and storage battery type locomotives; mine tracks, signals, and switches, including track gauge, turnouts, frogs and switches; mine cars; mine fans; airways and shafts and booster fans; wire rope, ladders, and miscellaneous coal handling equipment; pumps for development work, permanent pumping stations, natural drainage, and effect of mine water on equipment; loading machines, belt, chain and shaking conveyors, installing and operating cutting and loading equipment; general mine timbering, preservation of timbers, and use of concrete and steel.

This Handbook is pocket size, loose-leaf, and will be kept up-to-date as recommendations are approved. Its price is $5. This includes a subscription to The Mining Congress Journal. For further information, address

The American Mining Congress

Why

do 25 Mining Machinery manufacturers use SKF bearings as regular equipment ?

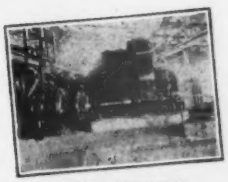


Crusher

Cutter

Mine Fan

Head Shaft


10' x 48" Mill

Conveyor

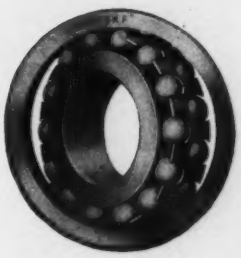
Because

nothing is apt to cost so much as a bearing that cost so little !

SKF

Ball Bearings Roller Bearings

SKF Spherical Bearing


SKF Self-Aligning Ball Bearing

It costs more to replace a poor bearing than to buy the best that SKF ever produced. SKF on a bearing, like the sterling mark on silver, represents a definite standard of quality, and you can depend on one just as surely as you can depend upon the other.

SKF INDUSTRIES, INC., 40 E. 34th St., New York, N. Y.

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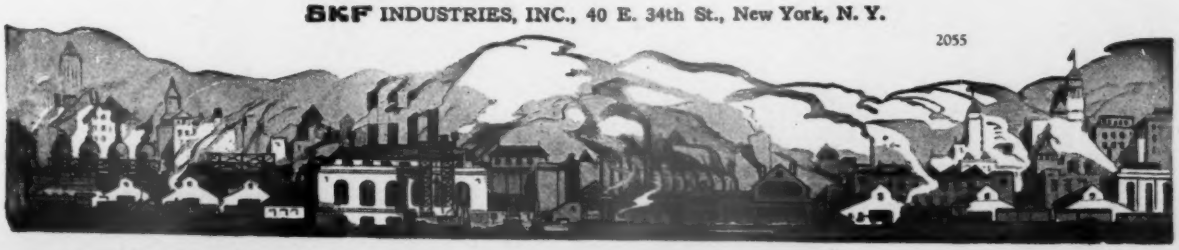
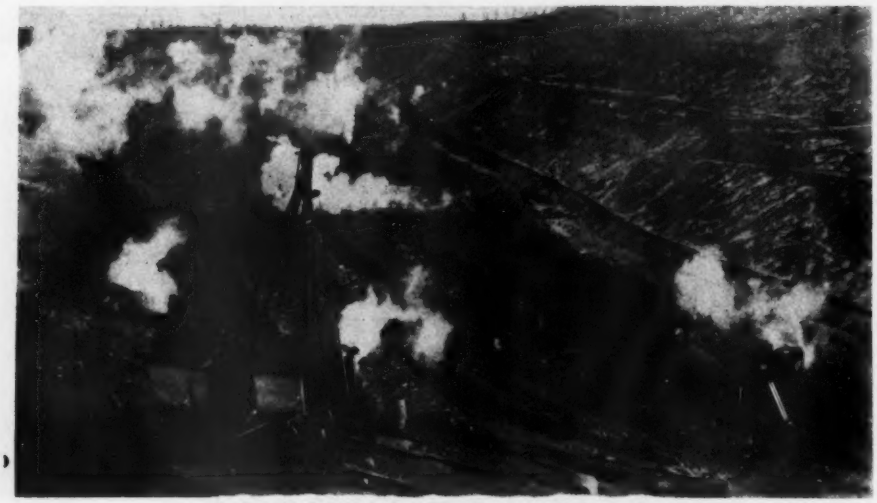




Anthracite Coal Stripping Operation near Hazleton, Pa.

In blasting off the overburden, which is a lightly stratified shale varying in depth from 10 to 50 feet, Cordeau-Bickford is being used

CORDEAU-
DETONATING FUSE
BICKFORD

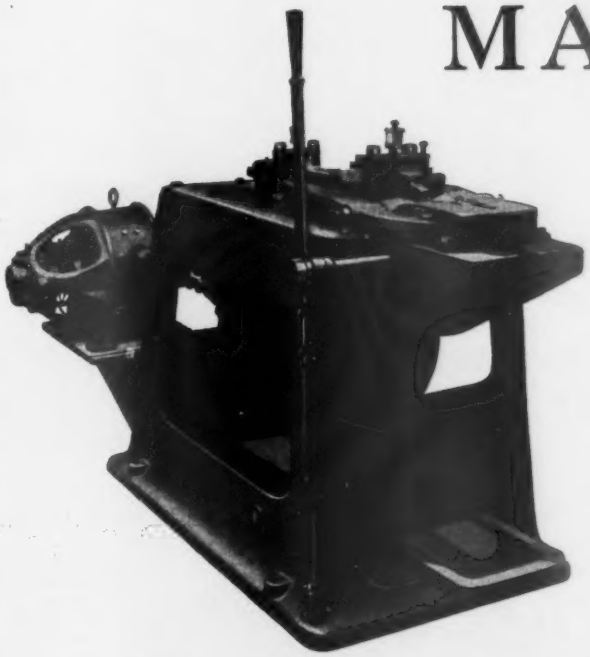
with very good success. Data on a blast shows 3.32 cubic yards of material blasted per pound of explosive used.

Let Cordeau-Bickford help you in uncovering your coal.

THE ENSIGN-BICKFORD COMPANY SIMSBURY, CONN.

DIAMOND BIT SHARPENING MACHINE

(It's New!)



THIS machine sharpens dull cutter chain bits or forms new ones from steel blanks by a hammering and drawing process—hand forging speeded up and mechanized.

Every bit is automatically straightened and forged to uniform shape and size in a fraction of the time required for hand forging.

The Diamond Bit Sharpening Machine is compact, self-contained and requires only 5 horsepower. Here is a cost cutting, labor saver that merits investigation. Write for details.

DIAMOND MACHINE COMPANY

Monongahela, Pa.

Sales Representatives

COOKE-WILSON ELECTRIC SUPPLY CO.
Pittsburgh, Pa., Charleston, W. Va.

PORTABLE LAMP & EQUIPMENT CO.
Bluefield, W. Va., Dugger, Ind., Birmingham, Ala., McAlester, Okla.

Canadian Representatives

PEACOCK BROTHERS, LTD.
Montreal, Cobalt, Vancouver

The Big 'Uns are coming, says Mr. Sanford-Day.

S&D Griffith Whopper Automatics. Any capacity up to 40 tons. For outside or inside use. For any sort of rock, or ore, or for coal.

S & D Griffith "Whopper-Automatics" Are Coming Fast! Tra La, Tra La.

At the plant of Pittsburg and Midway Coal Mining Company, Pittsburg, Kansas, being loaded by a 5-yd. Bucyrus Shovel.

22 Cars handled 1870 tons in 7½ hours.

Here they are in use— **The Car above→**

Sell Coal with Profit at Your Competitor's Cost!

Sanford-Day Iron Works, Knoxville, Tenn.

Use easy-running "S & D Wonder" wheels — Roller bearings guaranteed 10 years.

The Little 'Uns are coming, too,
says Mrs. Sanford-Day, Tra La, Tra La.

Showing Door-Latch being raised for tripping bottom

Doors down and being closed by passing over knuckle

S & D Drop-Bottom

Even Soviet Russia Buys Them!

Tested and Proved 8 Years

DeBardeleben, of Alabama, Has Just Thrown Away 500 Ordinary Cars and Has Installed 350 "Automatics."

Saving 10c. to 30c. a ton.

Sell Coal Profitably at Your Competitor's Cost And be Happy!

Why Not Investigate?

Cars passing over dumping point. Two cars empty—others loaded

The Storage Bin, showing coal leveled off automatically. Notice latch knocker

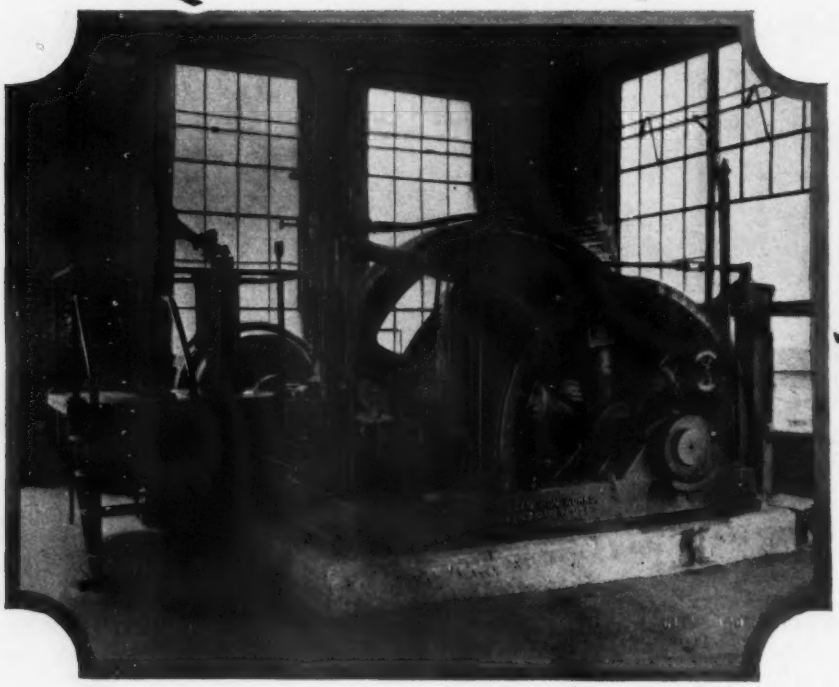
Knuckle that automatically closes doors

Sanford-Day Iron Works, Knoxville, Tenn.

Use easy-running "S & D Wonder" wheels — Roller bearings guaranteed 10 years.

A VULCAN HOIST

30%

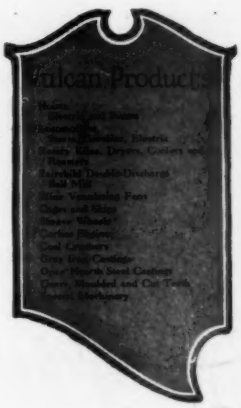


INCLINE

THIS hoist is equipped with a 7′ 0″ diameter by 4′ 0″ face drum and is driven by a 300 H.P. motor. It was installed at the Powhatan Mine of the Cleveland and Western Coal Company in 1923 and has given completely satisfactory service.

Unbalanced slope hoisting:

Length of haul	504 ft.
Pitch of slope	30%
Cars per trip	5
Weight of loaded car	11,000 lbs.
Rope speed	500 ft. per min.



Vulcan hoists are dependable and have the added virtue of economy in operation. Let us send you further descriptions.

VULCAN IRON WORKS OF *Wilkes-Barre, Pa. U.S.A.*

The
MINING CONGRESS JOURNAL
**A Monthly Magazine—The Spokesman For The Mining Industry—
Published By The American Mining Congress**

VOLUME 14 MAY, 1928 NUMBER 5

Editorials

May Seven to Eleven

FIVE days of concentrated effort applied specifically to solving the production problems of the bituminous coal industry cannot fail to bring gratifying results to that industry. The final program for the 5th Annual Convention of Practical Operating Men of the Coal Mining Industry is found elsewhere in this issue. It speaks for itself. It is the product of the combined efforts of approximately two hundred coal operators, each of whom has taken an active and earnest interest in its development. Such intelligent, coordinated and cooperative effort is bound to result in real advancement in producing coal efficiently, safely, and with a reasonable eye to conservation.

Beating the Standard

EACH year after the arduous labor of developing a program for the Cincinnati conventions, and arranging the expositions held in conjunction therewith, the industry rises and states: "This is the best convention and exposition yet held" and similarly, "You cannot hope to improve on it next year." But with each "next year" the problems of the industry advance, and the value of the conventions becomes more apparent. Consequently, the result is always "better" because the programs are keeping pace (if not setting it), with developments.

Five years ago a small group of manufacturers pooled their interest in coal through The American Mining Congress. They invited other manufacturers to share their belief in the value of cooperative effort as exemplified by that organization. The Congress in turn asked the operators to join in the movement to put all of the industry's production problems into one hopper, and turn the light of cooperative discussion on them. The result has been amazing, and yet no greater than could reasonably be expected when intelligent, earnest men put their shoulder to the wheel of progress.

The Manufacturers Division of The American Mining Congress deserves the kind words that have been directed toward it. It has earned them.

Management and Safety Problems

THE opening session of the Cincinnati meeting will be devoted to a discussion of the problems of management, which include as a major item the question of safe production. While each and every paper to be presented at the annual convention of coal operating men will give due consideration to Safety, the opening session will discuss it with particular reference to equipment that is especially designed to prevent accidents. The advancement of the rock-dust theory will be presented, with a review of what has actually been accomplished through its use. Also how the training and selection of personnel may contribute to Safety will be discussed. All of the papers at this session will be real contributions to the business of producing our coal supply.

Power and Transportation

THE adoption of the use of automatic sub-stations in the mechanical operation of a mine is a subject of importance to the mine operator. The development in the use of this equipment in the past few years is indeed enlightening. In the year 1927, 93 mines adopted this method of handling of power. One of the papers to be presented to the Cincinnati convention will show that the increase in savings because of the installation of automatic power equipment easily offsets the cost of the equipment in a period of 12 months. Likewise with the adoption of mechanical mining the question of transportation underground becomes one of major importance. Papers on successful haulage systems are a feature of the Cincinnati program.

Clean Coal

AS MARKETS become more specialized, the demand for prepared sizes of coal increases. The adoption of mechanical methods of production have increased the problem of the industry in this respect. Many companies are now mechanically cleaning their coal. Who is doing it successfully, and how, will occupy two full sessions at the Cincinnati meeting.

Mechanized Mining

AN INTERESTING feature of the recent survey on Mechanized Mining, is that out of the 7,177 companies producing coal 80 percent of the production was from 1,686 mines. How many of these mines were mechanized? What percentage of production were they responsible for? Cincinnati during the week of May 7, will answer these questions.

Progress in Mechanized Mining

THE three sessions of the convention to be devoted to the subject of mechanized mining will include state and sectional reports on how far mechanization has progressed, and will supplement the statements to be made by G. B. Southward, Mechanization Engineer of The American Mining Congress, who has been investigating this subject for the past 15 months, and of F. G. Tryon, of the United States Bureau of Mines. Thus these sessions will constitute

an up-to-date symposium, and will furnish reliable information on mechanized mining up to May 1, 1928. Such information should be of the greatest use and value to the industry, and will certainly make available data that previously has been from one to three years late.

Modern Methods

THE latest practice in blasting, drilling, cutting and shearing occupies an entire session of the convention. Interesting papers will be presented, two of them describing methods of blasting, that have not been discussed before.

Mechanical Loading has brought about many changes in production methods, and has necessitated a change in drilling practice. The use of drills mounted on loading machines is a new feature and will be discussed at Cincinnati.

Statistics on Mechanized Loading

FIGURES have been compiled by the United States Bureau of Mines giving the coal produced during the year 1926 by mechanized loading. This table appears in this issue of the JOURNAL and shows that over 10,000,000 tons of coal were mined by mechanical loaders and scrapers and an additional tonnage of well over a 1,000,000 tons is estimated to have been mined by conveyors, bringing the total production by mechanized mining to perhaps 12,000,000 tons of coal.

This table also shows that in 131 mines the mechanized equipment was on a practical operating basis and that 33 additional mines were using mechanized equipment but were not yet on an operating basis.

These figures have a two-fold significance. In the first place they show that mechanized mining increased more than 50 percent in the year 1926 and in the second place, they show that about 10 percent of our larger producing mines are now partially mechanized. These two facts are bearing out the predictions which have been made by those who have kept closely in touch with the progress of mechanized mining and should serve to convince the most skeptical that this development has reached proportions where it can no longer be ignored by the coal mining industry and that the new era in mining has arrived.

Tax Revision

CONSIDERATION of the 1928 Revenue Bill is being pressed, and it now seems certain that there will be a reduction in taxes. The House Bill has been amended by the Senate Finance Committee to include certain provisions of the 1926 Act that were proposed for repeal by the House, notably those relating to consolidated returns by corporations and corporate distributions from surplus accumulated prior to March 1, 1913. The nation's business will welcome the reduction in taxes, whatever it is; but there is keen disappointment among taxpayers generally on account of the fact that the bill accomplishes little or nothing in the way of administrative simplification. Due to administrative policies that have been inaugurated, followed, and even incorporated in the law, by the Treasury Department, the settlement of taxes has become a battleground of legal and administrative technicalities. The Joint Congressional Committee raised false hopes that this condition would be improved. But the present bill, instead of prescribing cures, proposed changes that would aggravate the situation; and some of these changes may get through, although the Senate Finance Committee eliminated those that were most objectionable.

The Joint Committee recommended simplification of existing procedure, prompt consideration and definite conclusions in the determination of tax liability, and elimination, in so far as possible, of legal technicalities. Instead of the new bill presenting such a program, it said in effect: the Treasury should have the right to reopen closed cases, disregard statutes of limitations whenever expedient, collect revenue without regard to how or where it is collected, or whether or not justice and equity are done. The Senate Finance Committee wisely rejected this program, and eliminated the major changes that carried such an implication.

It is going to be impossible to eliminate all the bad features of this bill in the time available to the Senate. To rewrite the whole bill would be a tremendous task, and would defeat tax reduction at this session. So taxpayers will have to be content with what is passed, and wait for better days.

Undeveloped Mineral Resources

NO GREATER service can be rendered the great agricultural areas of the South than to create local markets for farm products by the recovery of southern mineral wealth and its home manufacture into marketable products. Equally no greater service can be rendered to the railroads than the increase of freight tonnage of raw materials to points of fabrication, and through the return of these fabricated products to fill the requirements of mining communities. No greater service can be rendered to the South, or any other section of the country, than by increasing its taxable property, thus making possible better schools, better roads, and better public institutions, all of which are supported by taxation and by increasing business earnings.

We are therefore in complete sympathy with the recent action of The American Mining Congress in its publication of the useful book by Dr. Henry Mace Payne, its consulting engineer, on THE UNDEVELOPED MINERAL RESOURCES OF THE SOUTH, which offers a most complete catalog of information on the possibilities of southern mineral production. The book is the result of over four years of continuous field work and is perhaps the most extensive work ever undertaken voluntarily by any association solely to stimulate industrial development. The work embraces all available information of the undeveloped mineral resources in the several Southern States from Virginia to Texas. The American Mining Congress hopes through the publication of the book to not only awaken the South to the importance of its mineral possibilities but also to bring those undeveloped opportunities to the attention of industrialists generally.

Another Contribution to Industry

THE influence of transportation on civilization, the important part played by transportation systems in taxation and as consumers of raw material, and the effect of expeditious transportation on raw material stores, are discussed in a small volume released by The American Mining Congress, entitled NATURAL RESOURCES AND NATIONAL PROBLEMS. Much interesting information is given upon the present status of trunk line transportation in the United States, and in the chapter on taxation the author has summarized all systems of taxation. Additional chapters discuss government ownership of industry, power development and industry, economic development of power

and, labor and immigration. The book is a real contribution to economic thought and should command public attention.

Fields for Research

THE metal producing districts of the United States are constantly finding their problems increasing. In order to survive, methods must be found that will permit of the utilization of certain of their ores that have not yet been successfully recovered. Progress is being steadily made, and an intelligent and helpful interest is apparent. Within the past year 118 mining companies, representing widely different geographic locations, have submitted recommendations to the Bureau of Mining Economics of The American Mining Congress for fields of research. The diversity of these suggestions is amazing, and offer a very fertile field of rich material for our mining schools and to the government agencies created to assist industry in such problems.

The treatment of complex ores, or complex sulphide ores, assumes a prominent place in these suggestions. Geophysical prospecting, mechanical loading, saving of fine gold in placer mining, recovery of colloidal values, development of leaching methods as preferable to volatilization processes, beneficiation of iron and manganese ores, are a few of the suggestions and show their diversity.

We offer the above in the hope that with the knowledge of the desire and need of the industry, those contributing their energies to their solution may understand that there is a genuine interest in their work and a need for constructive effort to bring about a solution.

Has the Dollar Replaced the Gold Standard?

FEW of those subjects which are vital to every business transaction are less understood than that of our money medium. This indictment applies to many economists and many who are high in banking circles as well as to the layman who does not profess to know much about the subject.

We quote the following from the Literary Digest:

"The world is on a dollar standard, declares one of the foremost bankers of England, arguing that the dollar has actually replaced gold as the standard of world money values. 'The dollar no longer derives its value from the fact that it can be exchanged for a given amount of gold, but that amount of gold gets its value from the purchasing power of the dollar,' is the way the New York World states the revolutionary theory advanced by Reginald McKenna, former Chancellor of the British Exchequer, now head of the great Midland Bank of London. In England, according to The Wall Street Journal's London correspondent, no banker has replied to Mr. McKenna, and the daily press 'reluctantly agrees with him.' The New York Herald-Tribune's London correspondent feels that Mr. McKenna is 'justified by the logic of events.'"

It is to be noted however that the word "dollar" maintains its standing only when supported by an ample gold reserve and the effort to reverse this situation can lead only to disaster.

It would be a delightful thing if those nations of the world, wealthy perhaps in every other respect but lacking a gold foundation to support this money medium, could by assumption and argument, stabilize their money at par value. But the fact remains that only those countries that ever have or ever can maintain a stable face value to the exchange medium are those in which gold furnishes the basis of that value.

The stabilization of the world's finances rests everywhere and at all times upon a gold basis. Those nations like our own, fortunate enough to possess a sufficient amount of gold upon which to base their monetary structures are the only nations with unquestioned credit, with stable currencies and to which the less fortunate nations must appeal for credit. Economic discussion will not change this situation.

Very unfortunately for world business transactions, there is not enough gold in the world to stabilize the currencies of all countries. Very fortunately the United States possesses much more than its share as compared with those nations which have always maintained gold standards.

At this time the mining of low-grade gold reserves is an unprofitable enterprise. Our annual production in the United States is approximately one-half what it was before the World War increased price levels to that point where costs were in excess of the returns from low-grade gold deposits.

Sooner or later the advancing civilization of the world will demand a larger supply of gold and gold mining will again become a profitable business.

Why Not?

WHETHER the *Black Diamond* will get anywhere with its inquiry concerning "Why Not Federal Control of the Coal Industry?" is beside the point. Various operators have commented upon the editorial both favorably and unfavorably, but their percentage is so small when considered in relation to the whole coal industry that even by the most enthusiastic elasticity they cannot be said to be representative of coal's view of the idea.

It seems almost ridiculous to ask the question "Why not Federal Control?" and equally ridiculous to point out to coal men the very obvious answer. But unfortunately a minority, seeing no hope in the present situation, grasp at even the frail straw of politician control.

Let us point with pride (if we can!) to the record of the Government in business. Here it is:

The Shipping Board was designed by the politician to put the United States on the High Seas. This experiment has cost the taxpayer a staggering sum—something like three and one-half billions of dollars in 11 years, and is still operating at a cost of $20,000,00 annually, in the red. But aside from the monetary loss, we still have no Merchant Marine!

The Railroad Administration, which was created as a war measure to insure success in transporting materials, has cost the taxpayer an amazing sum. We recently—ten years after the War closed—made the final payment of $1,115,000,000 to clear out the deficit of government operation of our railroad system.

The Government in the construction industry is costing the taxpayer an enormous sum annually. An example of this being two identical bridges across the Potomac at Washington. The cost of construction was to be $1,000,000 each. One was given to private industry, the other to the Government. The result? Private industry completed construction in 11 months and one week, at a cost of $925,000; the Government completed construction in three years, four months, at a cost of $3,400,000.

What hope has the *Black Diamond*, or the any-port-in-any-storm coal operator, that the politician will be any more successful with the coal industry?

Rights Transgressed

UNDER what authority could the Federal government undertake to regulate or control the coal industry? If the production of coal is interstate comerce, then, likewise, the business of manufacturing shoes, clothing, and canned food, is interstate commerce. And the raising of oranges and lemons and garden truck for interstate distribution and consumption is interstate commerce. If Congress has any authority whatever over the operation of a mine and the production of coal, it has authority to step into any state and exercise regulatory powers over other business activities that are conducted wholly within the state on whatever grounds were used to justify such action in respect to coal mining.

There is no comparison between a coal mining operation and public utility doing an interstate business. Congress would not attempt to regulate or control an intrastate carrier by rail. A bus service or public utility concern operated wholly within the boundaries of a state is subject to state regulation only, and the Federal government cannot constitutionally step in without infringing on state authority. There will be some, however, who will continue to press Congress for regulation of the coal industry, regardless of constitutional rights, fundamental principles of government, or cost.

The Investigation Continues

THE Senate Interstate Commerce Committee, leisurely continues its investigation of the bituminous coal industry. Groups of operators have been in daily attendance, expecting to be called before the Committee to meet the charges of the United Mine Workers. So far, Pennsylvania, West Virginia, and Ohio operators have been heard. It is understood that operators from Indiana and Illinois will be called shortly. The Committee has kept these operators in Washington week after week waiting to be heard, at a cost that has mounted steadily both to the government and the industry.

West Virginia to the Front

WEST Virginia recently occupied the spot light before the Senate committee investigating the coal industry, and her sons held her banner high. J. G. Bradley, president of the Elk River Coal and Lumber Company, and W. H. Coolidge of the Island Creek Coal Company gave the Senators something to think about and unquestionably destroyed the structure erected by the United Mine Workers in their effort to throw coal into the political arena. Mr. Bradley and Mr. Coolidge, as did Mr. Chas. M. Schwab, proved by a record of performance the wisdom of cooperative relations between employer and employed. The records of these companies are splendid examples of the proper conduct of American industry.

Records of Performance

IF RECORDS of performance mean anything at all to the Committee of the Senate investigating the bituminous coal industry, the statements made before it by successful companies should go far in refuting the previous statements concerning the sad lot of the coal miner. For instance J. G. Bradley, a nonunion operator in the State of West Virginia, presented a record of 24 years of operation without a single day's interruption because of labor difficulties. In addition to that interesting fact, Mr. Bradley's men earn an average wage higher than the average shown for skilled and unskilled workers in 27 other industries as shown by the National Industral Conference Board through its investigation into hours and wages of labor. His company employs approximately 600 men, produces half a million tons of coal annually, and operates about 300 days annually.

The End in Sight

SENATOR Watson, Chairman of the Senate Interstate Commerce Committee, has expressed doubt as to the ability of his committee to complete its hearings on the coal industry in sufficient time to enable it to make any recommendations for legislation at this session of Congress. There is now every indication that Congress will adjourn about June 8th, and it is highly improbable that the committee will have completed its self-imposed task prior to that time.

But the fact that the committee is still in the midst of its investigation has not prevented individual members of Congress from offering their own idea as to what form legislation shall take. Several bills are in the process of formulation, including one by John L. Lewis of the United Mine Workers, and a large number of bills have already been presented for consideration. Their recommendations range from the creation of a coal commission of the Interstate Commerce variety to complete government ownership of the coal industry. There is, however, little likelihood that any of these bills will receive any consideration.

An Industrial Problem

DR. JULIUS KLEIN, Director of the Bureau of Foreign and Domestic Commerce, of the Department of Commerce recently stated:

> "The wastefulness of our distribution system is beyond question the gravest issue now before the industrial and commercial community of this country. The efforts of our business machinery to make headway with the present combination of scientific mass production and haphazard antiquated distribution, is like a modern giant capacity truck trying to deliver its load under the power of a one-lung motor."

Better Marketing for Industry has become a slogan. Legislation has been enacted that gives preferential rights to certain industries in their marketing, or distribution problems. The subject is one that has long occupied the attention of every branch of the mining industry. There are many who believe this problem to be the underlying cause of all of the troubles of the coal industry. Thomas F. Downing, Jr., in an article in this issue discusses this subject in relation to the coal problem, saying:

> "The quickest cure of the present economic troubles in the coal business would probably be consolidated sales by districts, much as the farmers of the west use their granges. * * * Much duplication of effort and unnecessary competition result from an excess in number of sales agencies."

The pooling of the interests in copper refining and marketing by the Phelps Dodge, Calumet and Arizona, New Cornelia and Nichols Copper Companies, is the latest effort of the copper producers to bring about more efficient methods of distribution. This industry already has created an organization—The Copper Institute—to study its marketing and distribution problems.

Dr. Klein states that the Department of Commerce receives something like 10,000 trade and distribution inquiries daily concerning this subject. He also points out that there are "some 540 agencies * * * including 50 government bodies," now directly working along the line of better distribution of products.

J. G. Bradley

President of The American Mining Congress.
President of the Elk River Coal & Lumber Co.

Underwood & Underwood.

James J. Callbreath

Secretary of The American Mining Congress.

H. K. Porter

Chairman, Manufacturers Division,
The American Mining Congress.
Hyatt Roller Bearing Company.

Dr. L. E. Young

Chairman, Program Committee, Fifth Annual Convention, Practical Coal Operating Men. Vice President, Pittsburgh Coal Company.

FIFTH ANNUAL CONVENTION *of* PRACTICAL COAL OPERATING MEN

Second Floor South Wing of Music Hall

Fifth Consecutive Meeting To Be Held At Cincinnati—Program Of Outstanding Importance To Discuss Many Phases Of Production—Exposition Of Modern Equipment To Supplement Discussions

A REAL high light in the present much-discussed "coal question" is the Fifth Annual Convention of Practical Coal Operating Men, to be held at Cincinnati, Ohio, during the week of May 7. With Congressional committees and certain newspapers playing up and magnifying what is wrong with the coal mining, the industry itself is earnestly engaged in going about its business of production and will come to Cincinnati in great numbers to tell what is right with the coal industry, and try to improve even upon that "right."

There have been those who have said that the coal industry is far behind the times in its production methods. The facts do not support that statement. While the industry as a whole has not been spectacular in forging ahead, there are many instances where individual performance has been decidedly spectacular. In the Year Book just published by the Mining and Loading Section of the American Mining Congress it is shown that while there were 7,177 mines in 1926 producing coal, approximately 80 per cent of the total production was by 1,668 mines, and it is this latter group that really tells the story of coal-mining progress.

These Cincinnati conventions are in themselves most definite refutation of the more recent indictments of the industry's lack of progressiveness. Attendance has grown steadily in the five-year period of their existence, until in 1927 more than 3,000 men participated. This year's meeting gives promise of surpassing even that imposing standard.

The Program, which is found in full on the following pages, is complete evidence of the interest the industry is taking in these meetings. Fifty-six papers will be presented, each by the representative of a coal-producing company that is thoroughly qualified to discuss the subject. An equal number of operators will lead the discussions following the presentation of the main papers. In this manner approximately 125 men will actively participate in the presentation of information to the meeting. These presentations will be supplemented by informal discussion from the floor of the convention, and the final result will be a symposium on coal-mining production unexcelled in the history of the industry.

In addition to those who directly participate in the program itself, 74 operators have cooperated in its development, constituting a Program Committee representing every producing district in the United States. Under the able leadership of Dr. L. E. Young, Vice President in Charge of Operations, of the Pittsburgh Coal Co., this committee has taken an active interest in the arrangement of the Program. They may well be proud of the result, and certainly are entitled to a special vote of thanks from the industry for their effective and unselfish cooperation.

In all, the development of this Program has required the active cooperation of more than 200 busy coal producers. They have cheerfully done their part, and the result should be a complete answer to many of the criticisms that are now directed at the industry.

The names of those who will present papers and those who will preside at the sessions will be found in the section of this Journal carrying the Official Program. The members of the Program Committee, with their official company affiliation, are as follows:

D. J. Carroll, *Woodward Iron Company;* Frank G. Morris, *Republic Iron and Steel Company;* Erskine Ramsay, *Alabama By-Products Corporation;* G. L. Chamberlain, *Southern Coal and Coke Company;* D. A. Thomas, *Montevallo Coal Mining Company;* Heber Denman, *Paris Purity Coal Company;* D. R. Stout, *Colorado Fuel and Iron Company;* F. W. Whiteside, *Victor American Fuel Company.*

Dr. E. E. Fyke, *Marion County Coal Company;* Ralph D. Brown, *Brewerton Coal Company;* Carl Lee, *Peabody Coal Company;* Geo. B. Harrington, *Chicago, Wilmington and Franklin Coal Company;* J. D. Zook, *O'Gara Coal Company;* G. E. Lyman, *Madison Coal Corporation;* D. D. Wilcox, *Superior Coal Company.*

W. J. Freeman, *Fayette Realty and Development Company;* David Ingle, *Ayrshire Coal Company;* Hugh Shirkie, *Shirkie Coal Company;* Robert J. Smith, *Deep Vein Coal Company;* Carl J. Fletcher, *Old Knox Mining Company;* T. C. Mullins, *Sunlight Coal Company;* Earl Oliphant, *Standard Coal Company.*

W. C. Shank, *The Carbon Coal Company;* Erle S. Ormsby, *G. M. Donk Bros. Coal and Coke Company;* W. K. Kavanaugh, *Southern Coal and Coke Company;* C. C. Wilcox, *St. Louis and O'Fallon Coal Company.*

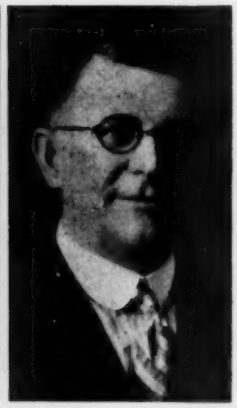
T. E. Jenkins, *West Kentucky Coal Company;* R. E. Galbreath, *Wisconsin*

W. C. Snyder

E. J. Christy

Charles Enzian

Thos. H. Clagett



F. B. Dunbar

W. C. Shunk

T. F. McCarthy

Paul Weir

Steel Company; W. M. Pearman, *Edgewater Coal Company, Inc.;* F. C. Mahan, *Harlan Coal and Coke Company;* G. M. Gillette, *Consolidation Coal Company;* Dr. J. J. Rutledge, *Maryland State Bureau of Mines.*

W. D. Brennan, *Stag Canon Branch, Phelps Dodge Corporation;* C. T. Griswold, *A. T. and S. F. Ry. Co.;* O. Huber, *Albuquerque and Cerrillos Coal Company.*

Ezra Van Horn, *Clarkson Coal Company;* W. L. Robison, *Youghiogheny and Ohio Coal Company;* R. L. Ireland, *M. A. Hanna Coal Company;* E. L. Thrower, *Warner Collieries Company;* E. J. Christy, *Wheeling Township Coal Mining Company.*

Geo. F. Osler, *Pittsburgh Terminal Coal Company;* Frank Dunbar, *Hillman Coal and Coke Company;* T. F. McCarthy, *Clearfield Bituminous Coal Corporation;* B. H. Stockett, *Chas. M. Dodson and Company;* A. B. Kelley, *Humphreys Coal and Coke Company;* J. B. Warriner, *Lehigh Coal and Navigation Company;* Floyd G. Wilcox, *West End Coal Company;* N. G. Alford, *H. N. Eavenson and Associates;* C. Law Watkins, *Pennsylvania Coal and Coke Company;* E. J. Newbaker, *Berwind-White Coal Mining Co.;* Dr. L. E. Young, *Pittsburgh Coal Company;* Percy C. Madeira, *Madeira, Hill and Company;* T. R. Johns, *Bethlehem Mines Corporation.*

C. E. Abbott, *Tennessee Coal, Iron and Railroad Company;* G. S. Jones, *Ohio Collieries Company;* Geo. A. Schultz, *Liberty Fuel Company;* Walter F. Clarke, *Independent Coal and Coke Company;* D. D. Muir, Jr., *U. S. Fuel Company;* Geo. W. Craft, *Pocahontas Fuel Company;* Lee Long, *Clinchfield Coal Corporation;* H. S. Estill, *Stonega Coke and Coal Company.*

Humphrey D. Smith, *Ashland Coal and Coke Company;* F. S. Follansbee, *Melcroft Coal Company;* Edward Graff, *The New River Company;* A. R. Beisel, *Island Creek Coal Company;* Jay I. Snoderly, *Bethlehem-Fairmont Coal Company;* Harry Gay, Jr., *Gay Coal and Coke Company;* Arthur Downing, *Monitor Coal and Coke Company;* Thomas Clagett, *Pocahontas Coal and Coke Company;* Thomas G. Fear, *Consolidation Coal Company;* E. P. Lucas, *Bellingham Mines Company;* A. W. Dickinson, *Union Pacific Coal Company;* Edward Bottomley, *Sheridan-Wyoming Coal Company;* Glen Knox, *Gunn-Quealy Coal Company.*

SPEAKERS AT THE FIFTH

There will be eight sessions of the convention. These begin Monday afternoon, at 2 o'clock, and end with the Friday morning session, May 11. The opening session discusses Problems of Management and Safety, and is followed by discussions on Power and Transportation; Coal Cleaning; Mine Mechanization and Cutting; Shearing, Snubbing and Blasting.

The convention formally opens on Monday morning, May 7, with registration of delegates and informal inspection of exhibits. The morning of the 7th was left open by the Program Committee for the express purpose of giving delegates an opportunity to properly register, visit with their friends, and inspect the exhibits prior to the opening session. The exposition will be opened at 9 o'clock Monday morning, and it is hoped that as many delegates as possible will take advantage of the opportunity offered for inspection.

One of the special features of the convention is the complete change in method of presentation of papers. There will be no formal papers. All papers will be printed in advance and distributed to delegates prior to the convention sessions. The author will then brief his paper, presenting the high points in a period not to exceed 10 minutes, leaving the balance of the time free for discussion from the floor. The committee feels that in this way there will be more informal discussion and that delegates will get considerably more out of the convention.

Another feature is the completely renovated Music Hall where the convention and exposition will be housed. This hall is now one of the most modern exposition buildings in the United States, completely equipped with every facility to make the meeting a success. The con-

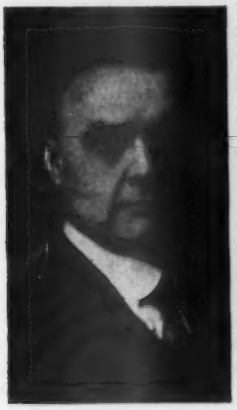
Thomas W. Gray

J. B. Pauley

H. A. Treadwell

Joseph T. Clark

J. R. Henderson



John E. Jones

H. S. Gilbertson

J. T. Jennings

ANNUAL COAL CONVENTION

vention hall where all sessions will be held is equipped with radio audification, thereby completely eliminating the very bad acoustics noticeable in previous years. The hall itself is beautifully appointed and decorated, and every effort will be made to take care of all the needs of delegates. A first-class dining room will be conducted at the hall; telephone and telegraph facilities will be accessible, and delegates may have their mail sent in care of Convention Headquarters, where it will be held until called for.

The Hotel Gibson is the Official Convention Headquarters. This hotel has added many features since last year, and is even better equipped to take care of the delegates. All special entertainment features will be held at the Gibson Hotel. Cincinnati has many well-conducted hotels, with ample facilities to take care of all the delegates.

The Cincinnati Coal Exchange is cooperating with the convention management in the matter of entertainment. They have arranged for golf privileges at all of the Cincinnati clubs. They will also act as hosts jointly with the American Mining Congress at the Reception and Dance on Monday evening, May 7, and at the Informal Dinner and Dance on Thursday evening, May 10. They have arranged special entertainment for the visiting ladies, including a Bridge and Tea at the Maketawa Country Club, and a special trip to the Rookwood Pottery Plant.

The Cincinnati Chamber of Commerce, through Mr. homas Quinlan, has cooperated with the sponsoring organizations, and is at the service of the visiting delegates for any assistance they may require. Miss Amy Pace, Assistant Secretary of the Chamber and Official Hostess for Cincinnati, will gladly be of assistance to the visiting ladies in the matter of information about local facilities or in any other way in which the chamber may assist delegates.

The famous Cincinnati Reds will play on the home field during the week, and the Music Hall management offers a special feature in entertainment on Wednesday evening of each week.

These conventions are serious affairs. The men come prepared to give information and to get it. They have never yet gone home disappointed, and there is no indication that this 1928 meeting will not far surpass previous years both from the getting and giving standpoint.

The Fifth Annual Exposition of Mine Equipment will be held in conjunction with the convention. One hundred and fifteen manufacturers of mining equipment and supplies will participate.

While the Exposition will be housed as usual in Music Hall, where previous exhibits have been installed, the hall itself has been completely renovated, making it one of the finest exposition buildings in the country. All exhibits and sessions of the convention will be in South Hall, which is the south wing of the building. Exhibits will be placed on both the first and second floors, and a section of the second floor will be utilized as a meeting room for the convention.

Registration of delegates to the convention and the headquarters of both the convention and exposition will be in the lobby of Music Hall, which will also be the main and only entrance and exit to the exposition and the convention.

Everything looking to the most complete mechanization of the mine will be on display, an approximately complete list of exhibitors and their products being as follows:

Ahlberg Bearing Company, "CJB" Master Ball Bearings and Ahlberg Ground Bearings; Allen & Garcia Company, Tipple Constructors, Builders of Coal Cleaning Plants; American Car & Foundry Company, Plain Bearing Wheels and Roller Bearing Wheels; American Cast Iron Pipe Company, Cast Iron Pipe; American Mining Congress, Convention Headquarters; American Rheolaveur Corporation, Model Rheolaveur Plant and Working Model Sealed Discharge Launder and Rheo Boxes; American Wood Impregnation Corporation, Samples of Wolmanized and Untreated Woods; Ames Shovel and ool Company; Plain Back, Black Shovels, Hollow Back Loco-

motive Scoops; Atlas Powder Company; Explosives.

Bethlehem Steel Company, Loaders and Conveyors, Track Equipment, Low-Type Mine Car, Steel Pipe; Broderick & Bascom Rope Company, Wire Rope; Brown-Fayro Company, Hoists, Car Retarder, Mine Car Loader, Mine Car Equipment.

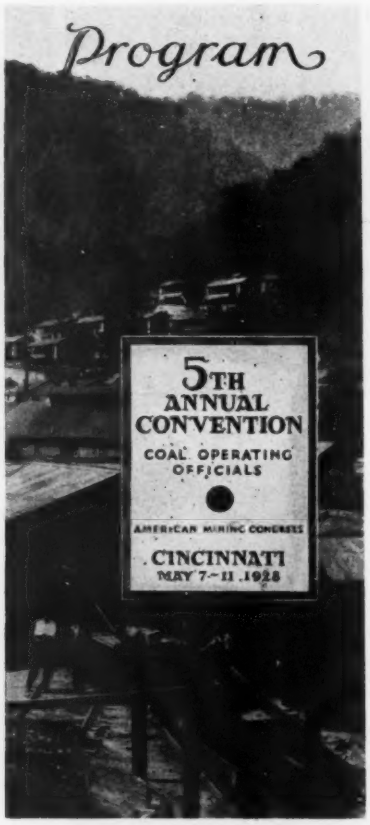
Carnegie Steel Company, Steel Mine Timbers; Chicago Pneumatic Tool Company, Drilling Machines, Riveting Hammers, Portable Tools; Chance Coal Cleaner, Coal Preparation Equipment; Coal Cleaning & Equipment Corporation, Coal Preparation Equipment; Coal Mine Management, Publications; Concordia Electric Company, Lamps, Shot Firing Attachment, Flood Light; Conveyor Sales Company, Inc., Conveyors, Conveyor Drives; Curtin-Howe Corporation, Wood Preservatives; Deister Concentrator Company, Coal Preparation.

G. R. Delamater, Testing Devices; The Deming Company, Mine Pumps; Dravo-Doyle Company, Pump Equipment; E. I. Du Pont de Nemours & Company, Inc., Explosives, Ventilating Tubing.

Eagle Iron Works, OC4 Type Olson Self-Dumping Cage, OC6 Type Cage; Edison Storage Battery Company, Batteries, Lights; Electric Railway Equipment Company, Trolley Devices; Electric Railway Improvement Company, Welding Outfits, Accessories, Welding Rods, Rail Bonds; Electric Storage Battery Company, Electrical Equipment; Enterprise Wheel & Car Corporation, Mine Car and Mine Car ruck.

Fairbanks, Morse & Company, Pumping Equipment; Flood City Brass & Electric Company, Track Equipment; Fort Pitt Mine Equipment Company, Control Devices for Mine Equipment; Frederick Iron & Steel Company, Coal Separator and Feeder.

General Electric Company, Permissible Motors, A. C. and D. C. Motors; Goodman Mfg. Co., Locomotives and Slabbing Machine; The Grasselli Powder Company, Explosives; Hazard Wire Rope Company, Wire Rope; Hendrick Manufacturing Company, Screens, Buckets, vator Buckets; Her- Gratings, Treads, Elecules Powder Company, Explosives; P. H. Holstein, Haulage Equipment, Track Equipment; Hockensmith Wheel & Mine Car Corporation, Mine Cars and Wheels; Hyatt Roller Bearing Company, Mine Car Roller Bearings and Journal Boxes.



The Program Cover

Ideal Commutator Dresser Company, Electrical Equipment; The Ironton Engine Company, Conveyor Equipment, Locomotives; The Jeffrey Manufacturing Company, Locomotive (gathering) Coal Cutters, Loaders, Fans, Tipple Equipment; Joy Manufacturing Company, Loading Machines.

Keystone Lubricating Company, Lubricating Apparatus; The Labour Company, Pumping Equipment; A. Leschen & Sons Rope Company, Wire Rope; Lincoln Steel and Forge Company, Lubricating Machinery, Compressor, Grease Plugs, Journal Box, Lincoln Truck (Model); Link-Belt Company, Conveyors; The Lorain Steel Company, Chain Face Conveyors, Mine Post Jacks, Mine Cars, Timber Jacks.

McGraw-Hill Catalog and Directory Company, Inc., Publications and service of above company; The Martindale Electric Company, Commutator Undercutting Machines, Portable Electric Blowers, Suction Outfits, Electric Insulation Testing Instruments; The Mine Safety Appliances Company, Safety Equipment; Mining Congress Journal; Mining Engineering Company, Ltd., Conveyors; Mining Safety Device Company, Track Equipment; Minter Homes Corporation, House Plans; Modern Mining, Copies of the Publication; Morrow Mfg. Co., Tipple with Screening and Picking Units; Myers-Whaley Co., Inc., Mine Shovels.

National Carbon Company, Inc., and Union Carbide Company, Carbon Brushes, Generators, Converters; National Malleable Steel Castings Company, Neco Steel Products, Mine Car Equipment, Chain; New Departure Manufacturing Company, Ball Bearings; Niagara Counterflow Screen Company, Screens; R. D. Nuttall Company, Track Equipment.

Ohio Brass Company, entire line of Overhead Equipment, Head Lights, Insulators, Rail Bond; Orville Simpson Company, Preparation; Osborne Register Company, Cash Registers.

Pennsylvania Crusher Company, Preparation; Phillips Mine and Mill Supply Company, Mine Car Wheels, Tipple Chutes, Conveyor Equipment, Dumps; Pittsburgh Coal Washer Company, Preparation; Pittsburgh Knife & Forge Company, Car Forgings; Portable Lamp and Equipment Company, Lamps and Equipment; Post Glover Electric Company, Resistance Grids for Locomotives; The Pure Oil Company, Oil Apparatus.

Roberts and Schaefer Company, Coal Cleaning Equipment; Robinson Ventilating Company, Ventilating Equipment; J. A. Roebling's Sons Company, Wire Rope; Rome Wire Company, Cords and Cables.

Safety Mining Company, Cardox Safety Cartridge for Shooting Coal; Sanford-Day Iron Works, Inc., Mine Cars, Roller Bearing Wheels, Trucks; Simplex Wire & Cable Company, Wires, Cables; SFK Industries, Inc., Bearings, Conveyors; Streeter-Amet Weighing and Recording

First Floor, South Wing of the Music Hall

H. A. Buzby, First Vice-Chairman

C. L. Herbster, Second Vice-Chairman

F. J. Maple, Third Vice-Chairman

N. S. Greensfelder Honorary Chairman

OFFICERS OF THE MANUFACTURERS DIVISION, THE AMERICAN MINING CONGRESS

L. W. Shugg, Director of Exhibits
Through courtesy General Electric Company

J. C. Wilson Honorary Chairman

Company, Mine Scale Weight, Railroad Track Scale; Sullivan Machinery Company, Mining, Shearing, Cutting Machines, Loading Machine, Longwall Machine 12" High Hoist.

Templeton, Kenly Co., Ltd., Track Jacks and Timber Pulling Jacks; Timken Roller Bearing Company, Bearings, Loaders, Tipples; The Tool Steel Gear and Pinion Company, Mine Machine Parts; The Traylor Vibrator Company, Preparation Equipment; W. S. Tyler Company, Screens, Shakers, Screen Cloth; U. S. Bureau of Mines; Rock Dusting and Analyses of Coal Dust Mixtures.

The Watt Car and Wheel Company, Mine Cars (Models); Waverly Oil Works Company, Lubricants; Weinman Pump Mfg. Co., Mine Pumps; Weil Kilby Corporation, Track Equipment; Westinghouse Electric & Manufacturing Company, Haulage, Electrical Equipment, Hoist Equipment; West Virginia Armature Company, Electrical Equipment, Ball Bearings; West Virginia Rail Company, Track Materials.

Erskine Ramsay

Eugene McAuliffe

W. L. Robison

A. C. Callen

Geo. B. Harrington

E. J. Newbaker

A. B. Kelley

A. W. Dickinson

W. H. Lesser

SPEAKERS AT THE FIFTH ANNUAL COAL CONVENTION

Others taking part whose portraits were not available include: Richard D. Maize, R. L. Adams, C. W. Rhodes, R. M. Fleming, Thomas Fraser, R. G. Perry, C. P. Anderson, J. B. Morrow, B. C. Osler, G. P. Bartholomew, Thomas F. Steele, Eli T. Connor, F. G. Tryon, Heber Denman, D. A. Stout, E. E. Fyke, David Ingle, T. E. Jenkins, G. M. Gillette, H. S. Hopka, C. Law Watkins, R. E. Howe, Otto Herres, George M. Thorn, Jay I. Snoderly, Jerome C. White, George B. Pryde, Lee Haskins, W. H. Smitherman, H. F. McCullough, Sterling S. Lanier, E. E. Jones.

C. E. Watts

Dan Harrington

E. A. Holbrook

Newell G. Alford

EXPOSITION OPENS
MONDAY, MAY 7, 1928

9 a. m.

Registration of Delegates
and
Inspection of Exhibits

Official Program

FIFTH ANNUAL CONVENTION PRACTICAL COAL OPERATING MEN

Cincinnati, Ohio, May 7-11

Monday, May 7

2 p. m.

CHAIRMAN—*W. L. Robison, Vice-President, Youghiogheny & Ohio Coal Co.*

TOPIC: **MANAGEMENT AND SAFETY PROBLEMS**

"The Training and Selection of Personnel."
By H. S. GILBERTSON, Director of Personel, Lehigh Coal and Navigation Co., Lansford, Pa.

"General Underground Supervision."
By H. A. TREADWELL, Chief Engineer, Chicago, Wilmington & Franklin Coal Co., Orient, Ill.

"Advancement of Rock Dusting Practice."
By CHAS. ENZIAN, Mining Engineer, Berwind-White Coal Mining Co., Windber, Pa., and J. E. JONES, Safety Engineer, Old Ben Coal Corp., West Frankfort, Ill.

"Safety Equipment to Prevent Accidents."
By D. HARRINGTON, Chief Engineer, Safety Division, The United States Bureau of Mines.

"Ventilation of Gaseous Mines"
By RICHARD D. MAIZE, Mine Inspector, Uniontown, Pa.

General Discussion—

Tuesday, May 8

9 a. m.

CHAIRMAN—*A. C. Callen, Professor of Mining, University of Illinois.*

TOPIC: **POWER AND TRANSPORTATION**

"Haulage Systems."
a. Capacity and Design of Mine Cars.
By C. E. WATTS, Mechanical Engineer, Berwind-White Coal Mining Co., Windber, Pa.
b. Haulage System with Gathering Locomotives Only.
By R. L. ADAMS, Mining Engineer, Old Ben Coal Corp., Christopher, Ill.
c. Track Systems.
By C. W. RHODES, Genl. Mgr., Fork Ridge Coal & Coke Co., Fork Ridge, Tenn.
d. Underground Transportation at Ebensburg Coal Company.
By R. M. FLEMING, Engr., Ebensburg Coal Co., Colver, Pa.

"Power."
Pumping at the Philadelphia & Reading Coal & Iron Co.
By J. T. JENNINGS, Power Engineer, P. & R. C. & I. Co., Pottsville, Pa.
Supplying Power Through Automatic Sub-Stations.
By W. C. SHUNK, General Manager, Stonega Coke & Coal Co., Big Stone Gap, Va.

General Discussion—

Tuesday, May 8

2 p. m.

CHAIRMAN—*E. A. Holbrook, Dean, School of Mines, University of Pittsburgh.*

TOPIC: **COAL CLEANING**

"General Principles of Cleaning Coal by the Dry Cleaning Process."
By THOS. FRASER, Consulting Engr., Pittsburgh, Pa.
(a) Dry Cleaning at the Berwind-White Coal Mining Co.
By E. J. NEWBAKER, General Manager, Berwind-White Coal Mining Co., Windber, Pa.
(b) Coal Cleaning at the New River & Pocahontas Cons. Coal Co.
By R. G. PERRY, Supt., Pocahontas Div., Berwind, W. Va.

"General Tipple Practice."
By C. P. ANDERSON, Chief Coal Inspector, New River Company, Macdonald, W. Va.

General Discussion—

Wednesday, May 9

9 a. m.

CHAIRMAN—*A. B. Kelley, General Manager, Humphreys Coal & Coke Co.*

TOPIC: **COAL CLEANING**

"General Principles of Coal Washing."
By J. B. MORROW, Consulting Engineer, Pittsburgh Coal Co.
(a) Coal Washing at The Shamokin Coal Co.
By B. C. OSLER, General Superintendent, Shamokin Coal Co., Shamokin, Pa.
(b) Coal Washing at American Smelting, Refining & Mining Co.
By G. P. BARTHOLOMEW, General Manager, Coal Mining Dept., American Smelting & Refining Co., Cokedale, Colo.
(c) Cleaning Coal at the Von Storch Colliery of South Penn Collieries Co.
By THOMAS F. STEELE, Superintendent, South Penn Collieries Company.
(d) Coal Cleaning as a Factor in Mechanical Mining and Present Day Marketing.
By ELI T. CONNER, Consulting Engineer, Scranton, Pa.

General Discussion—

Wednesday, May 9

2 p. m.

CHAIRMAN—*Dr. L. E. Young, Vice President, Pittsburgh Coal Company.*

TOPIC: **DEVELOPMENT IN MECHANIZED MINING**

"Resume of Present Development in Mechanization."
By G. B. SOUTHWARD, Mechanization Engineer, The American Mining Congress.

"Mechanical Production in Coal Fields of United States"
By F. G. TRYON, Statistics Div., U. S. Bureau of Mines, Washington, D. C.

"Roll Call by States to Show Present Development of Mechanized Mining and Progress Made During Past Year."

Alabama..... ERSKINE RAMSAY
Arkansas and Oklahoma.....HEBER DENMAN
Colorado and New Mexico..... D. A. STOUT
Illinois..... E. E. FYKE
Indiana.....DAVID INGLE
Kentucky.....T. E. JENKINS
Maryland.....G. M. GILLETTE
Montana..... H. S. HOPKA
Ohio..... E. J. CHRISTY
Pennsylvania:
Western .....N. G. ALFORD
Central .....C. LAW WATKINS
Tennessee ..... R. E. HOWE
Utah.....OTTO HERRES
Virginia.....GEO. M. THORN
West Virginia:
Southern..... THOS. H. CLAGETT
Northern.....JAY I. SNODERLY
Wyoming.....A. W. DICKINSON

General Discussion—

Thursday, May 10

9 a. m.

CHAIRMAN—*J. B. Pauley, Chairman of the Board, Miami Coal Company.*

TOPIC: **SUCCESSFUL MECHANIZED MINING OPERATIONS**

"Entry Development."

(a) With Mechanical Loaders.
JEROME C. WHITE, Production Engineer, Pittsburgh Coal Co., Pittsburgh, Pa.

(b) With Shaker Loaders.
GEO. B. PRYDE, General Manager, Union Pacific Coal Co., Rock Springs, Wyo.

(d) With Entry Drivers.
By GEO. B. HARRINGTON, Pres., Chicago, Wilmington and Franklin Coal Co.

"Room and Pillar Mining."

(a) Mechanical Loaders in Entries and Rooms.
J. R. HENDERSON, General Manager, Francisco Coal Co., Princeton, Ind.

(b) Conveyors in Entries, Rooms and Pillars.
F. B. DUNBAR, General Superintendent, Hillman Coal and Coke Co., Pittsburgh, Pa.

General Discussion—

Thursday, May 10

2 p. m.

CHAIRMAN—*Eugene McAuliffe, President, Union Pacific Coal Co.*

TOPIC: **SUCCESSFUL MECHANIZED MINING OPERATIONS**

"Long Face Mining."

(a) Mechanical Loaders in Entries and Long Faces.
LEE HASKINS, General Superintendent, J. K. Dering Coal Company, Clinton, Ind.

(b) Scrapers in Entries and Long Faces.
W. H. SMITHERMAN, General Manager, Wet Branch Coal Company, Dry Branch, W. Va.

(c) Conveyors on Long Faces.
W. C. SNYDER, General Manager, Consolidation Coal Company, Frostburg, Md.

"Conveyors in Rooms, in Anthracite Mines."
By W. H. LESSER, Mechanical Supt., Madeira, Hill & Co., Frackville, Pa.

"Rock Work With Mechanical Loaders."
T. F. MCCARTHY, Assistant General Superintendent, Clearfield Bituminous Coal Corp., Indiana, Pa.

General Discussion—

Friday, May 11

9 a. m.

CHAIRMAN—*G. M. Gillette, Gen. Mgr., Consolidation Coal Co.*

TOPIC: **CUTTING, SHEARING, SNUBBING AND BLASTING**

"Cutting and Shearing."
By H. F. MCCULLOUGH, Director of Engineering, Consolidation Coal Co., Fairmont, W. Va.

"Recent Developments in Drilling Equipment and Practice."
By THOMAS W. GRAY, Assistant General Superintendent, and J. T. CLARK, Superintendent, Mechanical Loading, Pittsburgh Coal Co., Pittsburgh, Pa.

"The Use of the C O 2 Cartridge."
By PAUL WEIR, General Superintendent, Bell & Zoller Coal & Mining Co., Ziegler, Ill.

"Use of Explosives in Self-Tamping Recoverable Cartridge."
By STERLING S. LANIER, Jr., Vice Pres., Norton Coal Mining Co., Nortonville, Ky.

"A Long Step Forward in Explosives."
By E. E. JONES, Genl. Mgr., Lillybrook Coal Co., Lillybrook, W. Va.

General Discussion—

ENTERTAINMENT

MONDAY, MAY 7—
Reception and Dance, 7.30 to 12, Gibson Hotel. Cincinnati Coal Exchange and American Mining Congress, Hosts.

TUESDAY, MAY 8—
Sight-seeing trip about Cincinnati, with visit to Rockwood Pottery, for Visiting Ladies.

WEDNESDAY, MAY 9—
Theater Party for the Ladies.

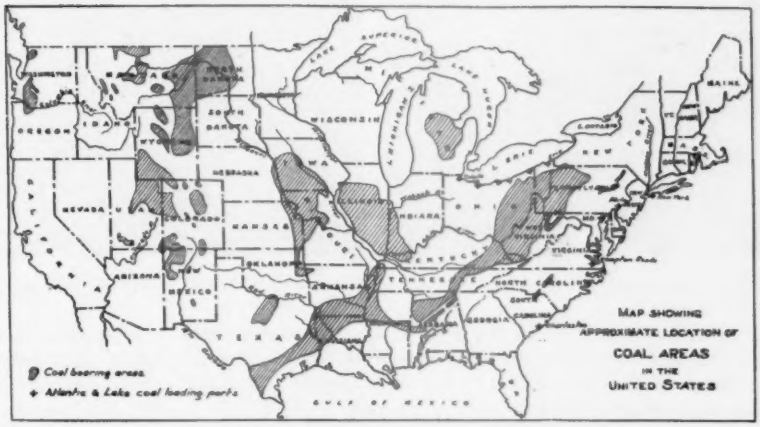
THURSDAY, MAY 10—
Informal Dinner and Dance, Gibson Hotel. Special feature entertainment.
Bridge and Tea at Maketawa Country Club for visiting ladies, by Cincinnati Coal Exchange.
Special Golf Privileges at All Cincinnati Clubs.
Cincinnati Reds Play on Home Field During the Week.
Special Entertainment by Music Hall Association.

LUNCHEONS
Members, Manufacturers Division.
Members, Mining and Loading Section, National Standardization Division, The American Mining Congress.
Program Committee.

NOTE: All Entertainment arranged for in cooperation with the Cincinnati Coal Exchange.

POOR OLD KING COAL

By Thos. F. Downing, Jr.*



MAP SHOWING APPROXIMATE LOCATION OF COAL AREAS IN THE UNITED STATES

With The Spotlight Turned On The Coal Industry And With The Many Conflicting Statements Being Made For And Against The Industry, Mr. Average Man Is Asking What It Is All About—An Analysis Of The Trouble With Old King Coal, And A Remedy Suggested

A FEW months ago the Secretary of Labor, Mr. Davis, called a conference of operators and United Mine Workers to discuss means of reducing the present-day losses in the industry. Many, who live at a distance from source of supply, will no doubt smile at the word losses as connected with coal production. They overlook costs of freight and distribution overhead and see only the cost delivered to them. The freight alone on over three-fourths of all coal shipped is greater than the cost of the coal at the mines.

There are some mines with ideal natural conditions, efficiently operated, or with a demonstrated superior product, which are making money, but these are greatly in the minority. The true condition is best reflected by the present market values of coal securities.

Last year the Interstate Commerce Commission reduced freight rates on coal originating in Pennsylvania, Ohio, and northern West Virginia for shipment to the Great Lakes. Recently the same commission refused to allow four southern railroads to reduce their lake cargo rates, which they had voluntarily cut 20 cents per ton to maintain rate differential between themselves and the northern carriers.

As this is written, the industry is being used as a political football by a Senatorial investigation into living conditions and contract relations in western Pennsylvania, Ohio, and northern West Virginia.

The above are just the high lights on outside interference. Flavor them with a dash of Federal Administration and Coal Commission, salt with overdevelopment and intense competition, and pepper with a few general strikes, and you have a mixture which only strong, hard-working men can digest.

Kinds and Amount of Coal in United States

It is hard to conceive figures concerning the remaining reserves in each of the five classes of coal. Some enlightenment, as to rank, location, extent, and uses is given in the following tabulation:

Rank or kind	Geographic location	Available amount in tons	Principal uses
Anthracite and semi-anthracite.	Eastern Pennsylvania	21,950,000,000	Domestic.
Semi-bituminous	Eastern Appalachian	49,650,000,000	Steam and domestic.
Bituminous	Central and Eastern States.	1,436,790,000,000	All purposes.
Sub-bituminous	Western States	983,322,000,000	Domestic and steam.
Lignite	Western States	1,046,827,000,000	Domestic.
	Total	3,538,539,000,000	

Lignite is a very poor coal, very high in moisture content and generally used near the place at which it is mined.

Generally all coals, except anthracite and semi-anthracite, are called bituminous or soft coal.

Production Statistics and Trend

At the present time approximately 600,000,000 tons of coal of all classes are mined annually. At this rate of production the total reserves would last over 5,000 years.

These coals are mined from 92 producing districts located in 32 states.

In the year 1889 the energy of the United States was supplied by the following power in their respective percentages. Bituminous coal, 58 percent; anthracite coal, 29 percent; oil, 5 percent; natural gas, 6 percent; and water power, 2 percent. Thirty-seven years after (year 1926) the energy demand was almost six times that of 1889, and the sources of that energy were: Bituminous coal, 60 percent; anthracite coal, 10 percent; oil, 20 percent; natural gas, 5 percent; and water power, 5 percent. It will be noted that coal continues to be the principal source for the tremendous energy required by our civilization, and is still king despite its many dictators.

Considering how vital its energy is to the Nation, its anticipated long life, and the ever-growing demands of the country, it may seem hard to understand why the industry is in a more or less demoralized condition, and a study of the underlying facts affecting it are in order.

Anthracite production is less than 15 per cent of the total, is more closely held, and confined to a relatively small area, so for the sake of brevity consideration of the larger bituminous problem will suffice.

Possibly the year 1924 more nearly represents the last normal year for consumption and production. The business

* Consulting Engineer, Philadelphia, Pa.

By-product coke

Water gas plant

of the country was then about average. Continental United States consumed almost the exact tonnage it mined, but about 17,000,000 tons were exported, the excess coming from storage. The performance of the carriers was practically perfect. Large producing districts, particularly western Pennsylvania, had not started their break with union labor. There were some local strikes, but no general one, and each district may be assumed to have gotten its share of the existing business.

For that year the Bureau of Mines gives 7,586 mines with rail connections in all states. However, a number of mines ship only one or two cars per week and have no effect on shipments or markets. For the purpose of comparison, 7,329 mines are used here.

These mines were owned by 5,175 companies, or an average of 1.4 mines to the company. Only one state, Wyoming, averaged more than two mines to the company.

They are equipped to produce the staggering output of one and a quarter billion tons per annum. The men now in the industry, together with miners who have entered other fields of labor but who would probably return with assurance of steady employment, are sufficient to mine approximately 900,000,000 tons per year to render development only 70 percent efficient. It is probable that, should demand be greater than the supply, the compensation would be high enough to attract sufficient labor and increased mechanization to meet all requirements. In any event, this generation need not fear lack of fuel to keep warm.

Against this tremendous potential capacity only 483,686,538 tons were produced in 1924. The average per mine of 66,000 tons per annum is a figure too low for economic production. Of course, some mines did not work at all, while others ran practically full time, but it is a striking fact that only 19.3 percent of the mines produced 100,000 tons or more each, and they supplied 72.8 per cent of the total output.

OVER-PRODUCTION, in large caps, is the descriptive term for most of the ills of the industry, and this condition is not confined to any particular field or locality. While the total business was only 37.3 per cent of the potential supply, only one state, Alabama, produced more than 50 per cent of its capacity. The nearest other state to the half-way mark was Virginia with 43.9 percent.

Thus, the industry is more than 60 per cent over-developed, while the 619,604 men actually employed averaged only 171 days work in 1924.

The percentages of capacities, shipments, and efficiencies of the five largest producing states are shown as follows:

State	Potenial capacity	Shipped in 1924	Efficiency
Illinois	14.0	14.1	37.6
Kentucky	9.3	9.3	37.3
Ohio	8.7	6.3	26.7
Pennsylvania	26.3	27.0	38.3
West Virginia	19.8	21.0	39.5

It will be noted that four of the five got their full proportion, or more, of the business. These five states have 78.1 per cent of the potential capacity and shipped 77.7 per cent of the production of the country.

The shipments for 1924 are within 4 percent of the average for the nine years following the war. As before stated, the figures given are thought to represent average conditions. Big strikes and similar disturbances may shift the percentages of the several states affected temporarily. As an illustration of this, Pennsylvania operators have been fighting the miners' union for the past three years. During that time she lost the place of the highest shipper, but practically no union coal is now mined, and so far this year the state has about won back first position.

Changing freight differentials may affect the prosperity of the various fields, but any gain in one field is at the expense of other fields, since only a certain total can be consumed by the country.

It is certain that so long as half of the normal production remains out of union control the country need fear no coal famine, provided transportation is always available.

Market Territories

Markets for a great part of the output of the five largest producing states are fairly well defined. The largest market is along the Atlantic seaboard, between New York City and Hampton Roads and extending west of Pittsburgh, Pa., and Cleveland, Ohio. The next largest market is along the Great Lakes within about a 250-mile radius of Chicago. The northwest and Canada take about 30,000,000 tons via the Great Lakes.

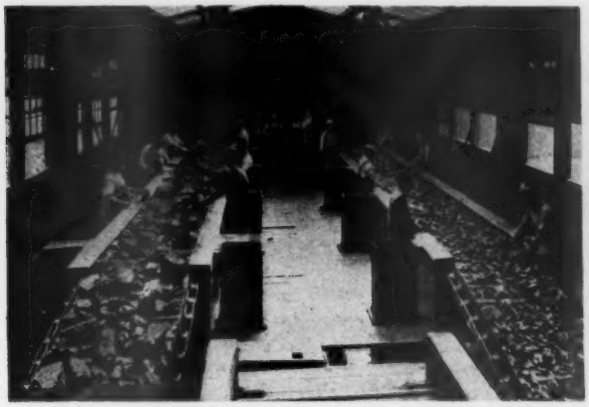
The New England States use about 9,000,000 tons of anthracite and 22,000,000 tons of bituminous coal per year. A great part of this is used near the Atlantic Coast and over half of it arrives in boats.

Five loading ports along the Atlantic Coast, New York, Philadelphia, Baltimore, Hampton Roads and Charleston, handle from thirty-five to forty-five million tons per year. This tonnage goes coastwise to Atlantic ports, for bunkering ships and for export.

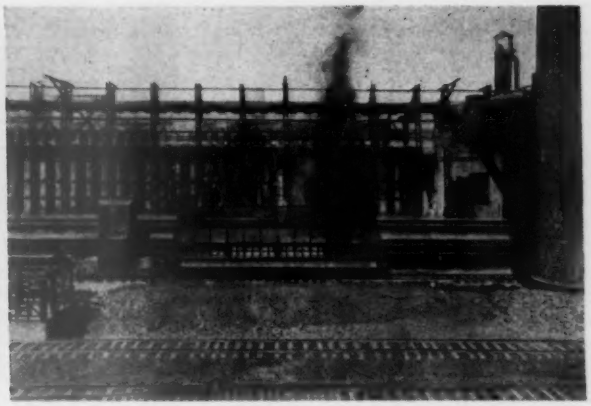
Our exports to Canada and Mexico are about 3 per cent, while to all other countries they average less than 1 percent of production.

Causes of Over-development

Public opinion was strongly focused on the troubles of the industry during the discussion of the Jacksonville agreement, but the underlying reasons for the over-production are not generally un-



Preparing domestic coal for market



A battery of by-product ovens

derstood even by many people in the industry. The principal ones are, in the order of their importance:

(*a*) *Improvement in the Facilities of the Carriers*

Prior to the war the potential capacity of the coal industry was at least double the tonnage required. If it had not been so the country would have suffered severely many times. The railroads were prepared to furnish cars for loading from three to four days a week, while the mines could naturally have worked six days if transportation and markets were available. Frequently districts were embargoed from shipping for several days even when cars were available. Such conditions kept price returns at a point where producers could make a fair profit. After Government control the railroads gradually added to equipment, expanded their yard and terminal facilities, and built helpful connections with other roads, so that by 1924 they were furnishing practically every car the mines called for. This brought on keen competition between mines of the same district as well as between producing districts.

(*b*) *Wartime Expansion*

During the war the country and its allies needed more coal, and our Government fixed a selling price which made the business look very attractive. Many new mines were opened and small mines were expanded. The number of mines increased 44 per cent from 1913 to 1918. This only served to dilute the already short car supply, and although the peak of production was reached in 1918 it was only 21 percent greater than in 1913.

The additions during wartime, and for some time later greatly inflated investment. All improvements and additions were made at excessive prices, and to add to this the Internal Revenue Department made rulings which were retroactive, and these improvements were all capitalized and in many cases the operator had to pay 40 per cent of the cost as taxes. This action put many companies in bad financial condition from which they have never recovered.

(*c*) *Increasing Demand for Coals Having Particular Characteristics for Special Uses*

The study of special uses for coal is most interesting but is, more or less, neglected by many in the industry. Coals must give gas of a certain B. T. U. and sulphur content to comply with requirements of many cities. That for metallurgical use must be low in ash, sulphur, and phosphorus. Consideration is given to the purity and texture of coke and quality and amounts of gas, ammonia sulphate, tars, and light oils recovered from coal. The reduced value for pig iron from each percent of ash in the coke used in its manufacture varies from 10 to 25 cents per ton.

It has been claimed that certain fields have been developed for 50 years before their time, but, as a matter of fact, the demand and search for purer special-purpose coals justified such development and these fields will continue to furnish discriminating markets, regardless of cost of production and unfavorable freight rates. This statement will be strongly disputed by many in the industry, so some supporting evidence is here given.

Over twenty years ago the U. S. Steel Corporation opened mines in the Pocahontas field of West Virginia, and has continued to ship the output to its Gary (Ind.) plant at a freight rate now $3.24 per ton. The freight rates from Indiana and neighboring Illinois coal fields would be less than $2 per ton. The difference in production cost as between union and non-union coal is about 50 cents per ton. There is something besides cost in a transaction of this kind made so long ago and continued to the present, and particularly, when needing more coal, the same company later opened mines in eastern Kentucky.

A steel company in Canada purchased and operates mines in West Virginia and uses the product in Canada.

Considerable coal is shipped to Chicago at a $3.09 freight rate, while that city could obtain coal from its own state with freight as low as $1.25 per ton.

Henry Ford purchased mines in West Virginia and Kentucky to supply his plant at Detroit.

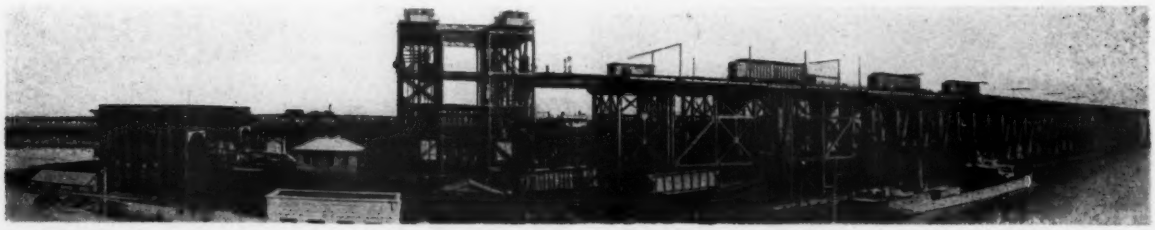
The city of St. Louis is within 10 miles of the Belleville field of Illinois, yet it gets its special-purpose coal from southern Virginia, Kentucky, and West Virginia at freight rates of $3.12 and $3.27 per ton.

Many other illustrations can be cited, but those given should be ample. Manufacture of steel and alloys has made tremendous strides in the past few decades, and it would be fruitless to attempt to prevent the development of raw materials, which made those improvements possible.

It is now realized that coal is most efficiently burned in powdered form. Last year there were built, or under construction, 187 power plants burning powdered fuel, and tests have shown that best results are obtained with coal whose ash fuses at the highest temperatures. There is enough high-fusion ash coal developed to serve any demands from this source, but it may result in further expansion of mines producing coals of that characteristic.

(*d*) *Increased Efficiency in Production and Combustion*

Production per man employed in the anthracite mines has fallen to 2 tons per day, but bituminous production per man day has increased from 2.98 tons in 1900 to 4.56 tons in 1924. The men in the industry in 1924 produced as much coal in 171 working days as the same



A loading pier at Hampton Roads

number would have taken 262 working days to produce in 1900.

Tremendous improvement in utilization of fuels has been made by improvements in plant design and operation in the past few years. From 1919 to 1927 the average number of pounds of coal required to produce one kilowatt-hour of electricity was reduced from 3.2 to 1.8. In 1927, public utility plants burned about 35,000,000 tons of coal less than they would have burned for the same energy by using equipment and methods in use in 1919.

The largest single class of consumers is the railroads, who burn about 120,000,000 tons per year. In 1920 they required 197 lbs. of coal for every 1,000 gross-ton freight miles, and in 1926 only 155 pounds. This saving took away the market for about 25,000,000 tons of coal.

Small consumers are gradually decreasing fuel requirements by experimenting to find the coal best adapted to their equipment and which will give the highest rate of condensation per pound.

(e) Competition of Oil as a Fuel

Fuel oil has made large inroads on coal in the past 10 years, as indicated by its rise during that period from 10 to over 20 per cent in the furnishing of the total energy demand of the Nation. Both anthracite and bituminous have suffered losses, but the former has felt it most in its domestic trade.

(f) Geographical Location of Producing Fields with Reference to Markets

The producing states which are isolated by freight rates from the highly competitive districts can more easily control development to conform to peak requirements, and their efficiencies are higher. We have seen that the five large producing states operate at from 26.7 to 39.7 per cent efficiency. The ratios of shipments to development in some of the isolated states are Alabama, 62.1, Colorado, 40.1; Kansas, 42.4; Montana, 41.0; New Mexico, 42.5; and Utah, 40.6 per cent. Virginia is well located to serve the rapidly growing demand of the rejuvenated South, and its efficiency was 43.9 per cent in 1924.

Thus, over-development is more acute in the large producing states which are tributary to common markets or outlets. This is caused by changes in basic labor rates, alterations in freight structures, and strikes, all detrimental to stabilization of production and markets.

Futile Remedies

Many are looking for a Moses to lead the industry out of chaos, forgetting that even Moses could not lead without willing followers.

Others are calling for a dictator, such as Judge Landis is to baseball and Mr. Hays to the moving pictures. Imagine Judge Landis controlling over five thousand league teams or Mr. Hays running more than seven thousand studios located between Washington and Alabama and Pennsylvania and New Mexico with Alaska thrown in for good measure.

The over-development has not taken place in the past few years. Conditions have merely arisen to stress it and bring it to public attention. In 1910 bituminous production was almost 85 percent as much as the average yearly production during and since the war. We cannot expect to cure it in a day or a week, nor can it be overcome by outside rulings or legislation without causing far more distress to those engaged in the business than would come about if left to itself.

Many times we have read the bold assertion that "the coal industry is antiquated and using the same methods of production that were in use a generation ago." There are many mines and some districts where progress has not been as rapid as it should, but generally the facts belie the claim. An increase of over 50 percent in 24 years may not be setting the world on fire, but it certainly is not standing still. This increase was made despite the great increase in number of units, which would act against such a showing. It was made possible by better organization, changes in methods of mining, and increased mechanization.

Industry Must Cure Itself—Suggestions to This End

There are several things which those involved can do for themselves, as well as natural conditions which will help, but to be permanent the cure must come from within the industry and treatment must of necessity be rather prolonged.

So far the operators have worked along individual lines, each trying to save himself. Some owners have retained higher-class executives, while others have called in men of wide practical experience to help point out possible savings. These methods may allow the individual company to stay in competition, but have no healthful bearing on the situation as a whole.

Some are trying to overcome freight differentials or wage rates by further mechanization, particularly mechanical loading of coal. This is still in the experimental stage, but at least 19 different kinds of loading equiment are in the market, and where such intensive effort is made some good is bound to result. Any success along this line will prove a temporary advantage to the individual, but the methods would gradually be adopted by the whole industry and, while the country would get cheaper coal, the over-production would be further intensified by the greater per-man efficiency necessary to make the methods successful.

Many operators claim that times such as they are now going through freeze out the small operator, but this is fallacious. They may remove the operator, but the physical property is in the hands of his creditors and ready to start work as soon as the prices justify it. Each time a property thus changes hands it usually does so with smaller invested capital and is in a better position to make earnings than it was before.

One of the greatest disturbers of markets and prices is distress coal, i. e., coal shipped with the idea of its being sold en route or on arrival and unbilled coal on the tracks at the mines.' Operators can remedy this condition immediately by not mining coal not sold and by balancing contracts. By the latter is meant the contracting of the correct proportion of each size sold. If an operator contracts 50 per cent of his anticipated production of lump coal over a given period, he should also contract the same proportion of the other sizes necessarily made in producing the lump. If not, it frequently happens that he must sell the resultant coal at a sacrifice in order to fill the lump order, and the resulting total return may be under the cost of production. If such a condition arises, and it frequently has in the past, the operator must take his

loss and, at the same time, reduce general market values, or repudiate the contract and get in bad repute with the trade.

This is distinctly an era of sales distribution, and coal is by no means the only commodity of which capacity exceeds demand. Other lines are meeting the situation militantly. Gas and electric companies maintain large show rooms in which are sold appliances which are helping to consume the surplus. Oil has invaded the domain of coal, and by advertising and various appliances has more than doubled its use as a fuel in the past 10 years. No such offensive has been taken by the coal trade, but public utterances have been mostly of a defensive nature only. Defense alone never won a fight.

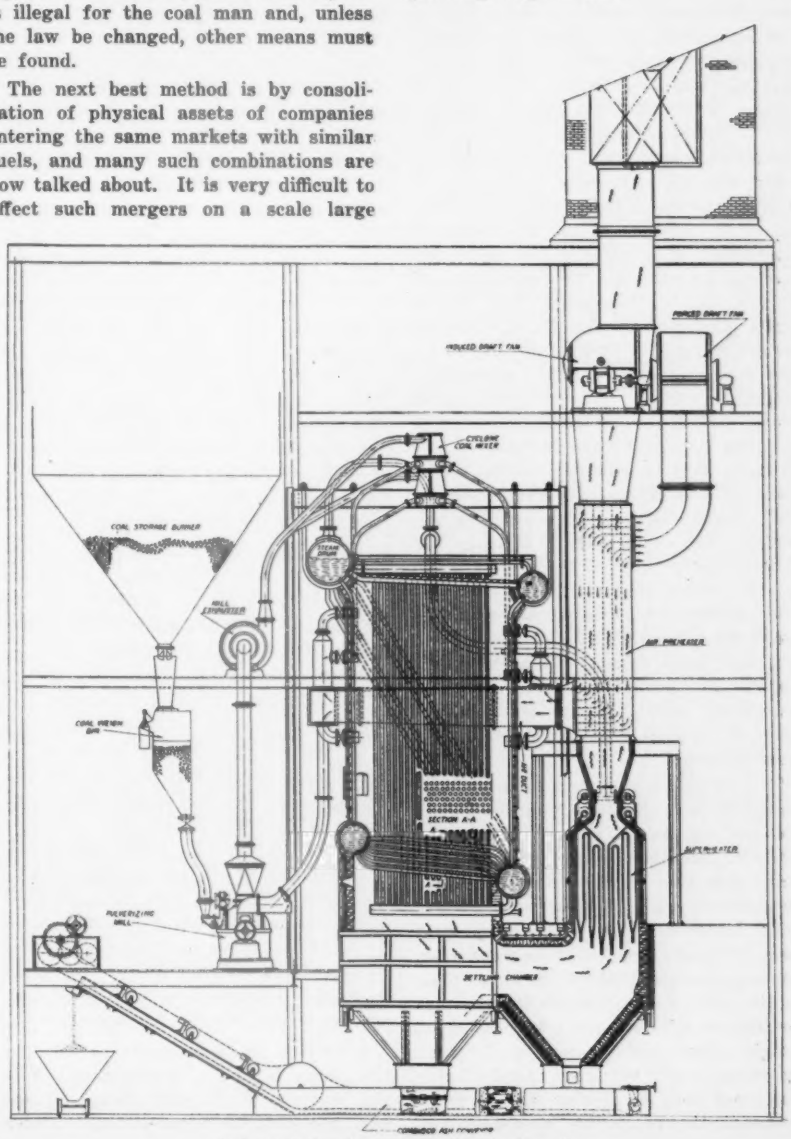
The limits of coal demands for the country are fairly well known, while the export trade is normally stationary, yet the coal industry has brought out no new uses for, or methods of, increasing those demands. Powdered fuel may save the industrial markets from oil, but the coal operators did not foster its use. It is a safe bet that not one coal salesman in a thousand can tell approximately how much it costs to pulverize the different classes of coal, what effect low-fusion ash has, or the general differences between water and nonwater cooled furnace walls. Fuel oil has entered the domestic field very extensively despite the fact that it is not as safe, cheap, or efficient as coal. The chief claim oil has is its convenience, and several coal-burning appliances have come on the market to give additional convenience in the burning of coal, but are generally frowned upon by the coal men, because they burn the cheaper sizes.

Only one and a quarter million tons are exported to South America, and that continent receives large tonnages from Europe. There is not a great difference in pit-mouth cost, but Europe has an advantage in short rail hauls and water transportation. Many of our developed fields lie on, or near, navigable tributaries of the Mississippi River. There is room here for some study in special ship construction and necessary subsidies for disposing of some of our surplus.

It may be claimed that the coal business is too loosely held to attempt investigation such as before referred to. Many companies are large enough to afford considerable investigation on their own. Several coal-producing states maintain large universities equipped with laboratories, libraries, and professors of ability. Most of the tonnage is represented in the National Coal Association or the American Mining Congress, and either organization could economically be expanded to study outside questions. The Bureau of Mines also stands ready to help where it can, and many coal men are members of the American Institute of Mining and Metallurgical Engineers and affiliated societies. Surely something constructive should come from one or more of these many sources.

The quickest cure for the present economic troubles in the business would probably be consolidated sales by districts much as the farmers of the West use their granges. This method would take the smallest outlay of capital and bring quick results. Much duplication of effort and unnecessary competition result from an excess in number of sales agencies. Some of them maintain competent staffs, but many have no investment in the business and are interested only in their commissions, regardless of price received for the product. As an illustration, the year 1921 saw 661 agencies sell only 27 per cent of the output. But, while consolidated sales may be all right for the farmer, Uncle Sam says it is illegal for the coal man and, unless the law be changed, other means must be found.

The next best method is by consolidation of physical assets of companies entering the same markets with similar fuels, and many such combinations are now talked about. It is very difficult to effect such mergers on a scale large enough to have lasting benefit. Every coal man thinks his mine is the best of its kind. Many have founded the companies they control, and there is a personal aversion to handling one's life work over to other control. Many of the later adventurers are still looking for a miracle which will let them out whole. Neither are willing to consent to their inflated values being reduced to a point where the new company can earn a fair return on the consolidated investments. Some hope for legislation which will permit collective bargaining, such as the farmers have, and thus allow them to retain ownership and operation of their properties. Any such consolidations made will first be by districts as, strange to say, the greatest competition is from mines in the same district. Such mergers, if large enough, will do a lot of good in stabilization of markets and operating wage scales.



A layout for burning pulverized coal

Most students of the situation say many mines must close, and probably many will. They will be closed either by consolidations or for markets, more by the latter. Buyers will take the best they can get for the money, and it is not surprising that many are experimenting to see which is the best. Some large users, such as General Motors, have already established a "permissible" list. Their experts have investigated sources of supply for all raw materials, and all supplies are purchased from the acceptable firms in their respective categories. A number who have used coal over a long period have also settled down to certain fuels as having been most satisfactory. In most cases the freight charges greatly exceed the purchase price, and many are learning that freight on excessive ash and moisture is waste. More are coming to this view, and eventually only the mines producing the best and purest coals will have business.

This method of elimination will take considerable time, but could be hastened by the operators should they care to gather and distribute certain information. Studies should be made of the characteristics of the coals shipped from each district, and each should be exploited for the use for which it is best adapted. Of course, the knowledge of particular requirements for each consuming district and use must precede this action. For instance, most of the grate equipment in the Chicago district is not suited to burning coking coals, and any sales effort for such coals there would be wasted. Another very useful bit of information would be the tonnage required for each grade and size of coal in each large consuming district. Also, what producing districts can expect to ship certain coals to each consuming territory. These data could be collected under the supervision of one of the beforementioned associations. Many coal men will say that such troubles are up to the consumer. The consumers are slowly learning these things, but such knowledge on the part of the producers would hasten the day of elimination and take much of the present guessing out of their own business.

In 1923 the State Legislature of Massachusetts appointed a committee to recommend means of "securing a continuous and adequate supply of anthracite coal," also the "effective substitutes for anthracite coal." Similar emergencies arise in different parts of the country in times of general strikes of long duration. Cooperation and constructive suggestions on the part of a representative coal organization, with adequate knowledge of freight rates and coal uses, in such emergencies may save uses of substitutes which are hard to displace and serve to maintain the confidence necessary between distributor and consumer. The consumer must have fuel regularly.

There is one major adjustment forcing itself on the business which is receiving little thought at this time, and that is the narrowing of difference in price for the many sizes of coal made. About 25 percent of all shipments are of a size which will go through a 2-in. screen. It is not so many years ago that this size of bituminous had no market, and was left in the mine or dumped on the hillside. Now mechanical stokers in steam plants have generally done away with costly and laborious hand firing and use this size, and it is becoming more difficult to sell run of mine coal except as railroad fuel. Many of the railroads are adopting stoker equipment for their engines, and it is reasonable to suppose that this practice will increase. Some coal is purchased for carbonizing in run-of-mine state and crushed, but the fine grade would do if properly prepared. Most of the new large industrial installations are for powdered fuel, and they will not pay lump or egg prices and the additional expense of crushing if slack coal is available. All new automatic appliances for domestic heating are fitted for burning the smaller fuel. The proportion of coal being used under 2-in. is rapidly drawing near to the halfway mark. With proper care and methods in preparation at the working face, or by mechanical preparation at the dump, this size can, for all practical purposes, be made as acceptable as the hand-picked larger sizes. The operator will be forced to ship this size clean, cease looking on it as a by-product, and demand a price which will allow it to carry its part of the load. It is an apparent fact that any hopes of increased use at this time lie in the smaller sizes.

It is generally thought that powerhouse efficiency is rapidly nearing its peak, and this fact, together with the steadily growing energy demand, makes things look somewhat brighter.

Many mines are rapidly depleting small acreages. These are usually low-tonnage producers, but their output has a decided influence on market prices.

Oil has perhaps done its worst in displacing coal in industrial uses. The swing is now the other way, and even some plants on the coast, where oil should be cheapest, are putting in new units for pulverized fuel. Recent tests have also shown powdered fuel superior to oil for shipping, and some gains can be expected from that source. Oil must be stopped in the domestic trade by demonstration and suitable propaganda.

According to Government records our oil supply is rapidly diminishing. Will the Western States, now using oil and gas, use coal or imported oil? Much depends on the attitude of the coal industry and means of transportation.

And lastly, there should be no encouragement to further development. New mines will be a very questionable investment for the next few years. Each year some mines are exhausted, but it will be some time before they will need replacing, particularly in the face of increasing efficiency in present mines. Recently three railroads were asking the Interstate Commerce Commission for permission to make one connection. This connection would open up about 20 miles of new coal territory, and it would be very hard to prevent development of that territory.

The way may be hard, but the future is not hopeless. Closer cooperation, a broader knowledge of the industry, and intelligent sales policies and distribution methods should bring results.

EXPERIMENTING WITH LIQUID AIR FOR BLASTING

BLASTING with liquid air is being tried out by German explosives authorities, according to a report to the Department of Commerce.

The liquid air method is claimed by its German proponents to offer advantages of lower costs and less danger and simplicity. Specially constructed carbon cartridges are saturated with liquid air, placed in borings of 70 centimeters depth, and exploded by means of an electric fuse. Since the oxygen evaporates quickly, it is essential that the explosion take place within 15 minutes of loading, and skilled workmen should be employed to prevent loss of time. Special caps and fuses are necessary to withstand the low temperature, but these are claimed to be not more expensive than the usual material. The cartridges are prepared in varying degrees of strength, which makes it possible to regulate the power of the explosion. For the obtainment of 1 ton of stone about 140 grams of air are necessary.

The element of danger is considered less than in the case of other methods, not only because the unsaturated cartridges and liquid air are equally harmless under separate transportation, but, if a load misses fire, the cartridge can be removed without possible injury to the workers, within 30 to 40 minutes, or as soon as the oxygen has evaporated. As compared with other methods, the costs are estimated to be 30 per cent lower.

A method of blasting with water is being applied in Germany at present, particularly in the case of foundations near or within city limits where it is undesirable to cause heavy shocks or concussions. A hydraulic pump forces water under a pressure of 400 atmospheres into specially prepared borings.

SAFETY ORGANIZATION *and* METHODS *of the* MADISON COAL CORPORATION

By H. T. BANNISTER *

Mine Rescue Car for underground use. Note injured man on stretcher suspended on chains.

Fundamentals Of The Safety Plan At This Property Are Capable And Experienced Men; Proper Equipment And Material With Which To Work—Although They Maintain A Large Safety Organization With General Safety Inspector, Assistant And Local Inspectors, They Are Convinced That Accidents Are So Generally Due To Individual Carelessness, That The Only Effective Means Of Approaching Problem Is Through Education Of Workmen—Special Training Given In Rescue And First Aid

WHILE the Madison Coal Corporation maintains a special department for the promotion of safety, yet its real organization for this purpose comprises the entire official family from the executive head of the company down to the most recent recruit to the supervising forces, all of whom are ardent boosters for safety and the prevention of accidents. To achieve a reasonable degree of success in the promotion of safety, however, just as in any other job, there is required:

First, capable and experienced men to handle the work.

Second, proper equipment for their use.

Third, material with which to work.

The right kind of men to direct the work can usually be found in any well balanced organization. They must of necessity be thoroughly experienced in the practical details of mining work, and earnest in their devotion to the continuous campaign for safety which it is their particular job to foster, as well as tactful and diplomatic in their contact with the men themselves.

Suitable equipment need not be unduly expensive. It should include several sets of approved breathing apparatus and accessories, first aid equipment and supplies, and preferably a fireproof place to keep same. A conveniently located place for lecture and instruction purposes, as well as for practice in mine rescue and first-aid work, should also be provided. Efficient fire fighting equipment, both above and below ground, is essential for personal safety and protection of property in times of trouble. Miscellaneous equipment will be suggested by the individual needs of different properties.

The third item, material to work with, comprises the great body of employes themselves, and unfortunately does not permit of the same careful selection that would prevail in a job which deals with material things alone. It is the introduction at this point of the human factor, and the extreme difficulty of directing, much less controlling it, that makes safety work difficult at times to the point of utter discouragement to any but its most enthusiastic advocates.

ORGANIZATION

The Safety Department comprises the following organization:

General safety inspector, assistant general safety inspector, supervisor of explosives, local safety inspectors (one for every two mines), captains and members of the permanently organized mine rescue crews at each mine, miners in charge of the district first aid stations inside the mine, ex-officio members—every supervising official at each plant.

The permanently organized mine rescue crews at each mine, and the miners in charge of the district first aid stations inside the mines, while constituting an important part of the general safety organization, are not salaried members thereof. The teams, however, are paid for all work done, such as mine rescue, fire fighting, etc., at the regular rates established by the State Department of Mines and Minerals for such services. Likewise the miners in charge of the underground district first aid stations are compensated whenever their work in this connection interferes with their regular duties. No payment is made for time spent in routine training and practicing first aid and mine rescue work.

The general safety inspector reports direct to the general superintendent in charge of operation, and receives the active co-operation of the different mine superintendents, each of whom is naturally anxious to make the best possible comparative showing for his own property.

EQUIPMENT

While personnel plays the most important part, yet the best efforts would be

* General Safety Inspector, Madison Coal Corp.

severely handicapped without proper equipment. There is provided, therefore, at each plant a mine rescue building particularly adapted to the requirements of the mine at which it is located. Each station is of simple design, fire-proof construction, and consists essentially of a large central room for lectures and practice, with a smoke chamber on one side and wash room, lockers and rooms for equipment and supplies on the other side and rear. Every station is equipped with a minimum of five complete sets of self-contained breathing apparatus and the necesary oxygen storage tanks, high pressure oxygen pump, and all the testing and charging equipment required in connection therewith. It also contains five all-service Burrel gas masks, one carbon-monoxide detector, six Super-Wheat permissible electric cap lamps, one mercury manometer, one flow meter, one large testing box for safety lamps, one Pyrotannic detector, one portable HH inhalator, one air analyzer, one dozen sampling tubes, one psychrometer, one dust testing kit, a life line 1,000 feet long, one dozen approved gas-testing safety lamps, and the usual first aid material of all kinds. A Homestake stretcher is also provided for bringing men up the shaft in case of accident or emergency when the regular hoisting facilities are not available.

Mine Rescue Team that won first prize at International Contest at San Francisco, September, 1926

Mines 9 and 12—Colored instructors who participated in 100 percent training of all employes.

An underground rescue room is maintained near the shaft bottom and is also equipped with first aid supplies, stretchers, blankets, etc., and is sometimes used as a temporary receiving room for injury cases where surgical attention is advisable before the injured party is taken on top.

Near the underground rescue room, on a special track reserved for its exclusive use, is maintained the mine rescue train. This comprises two special rescue cars, together with a forty gallon chemical fire extinguisher which is always kept charged for immediate use. This switch is never permitted to be blocked, and is open to ready access with a locomotive at all times.

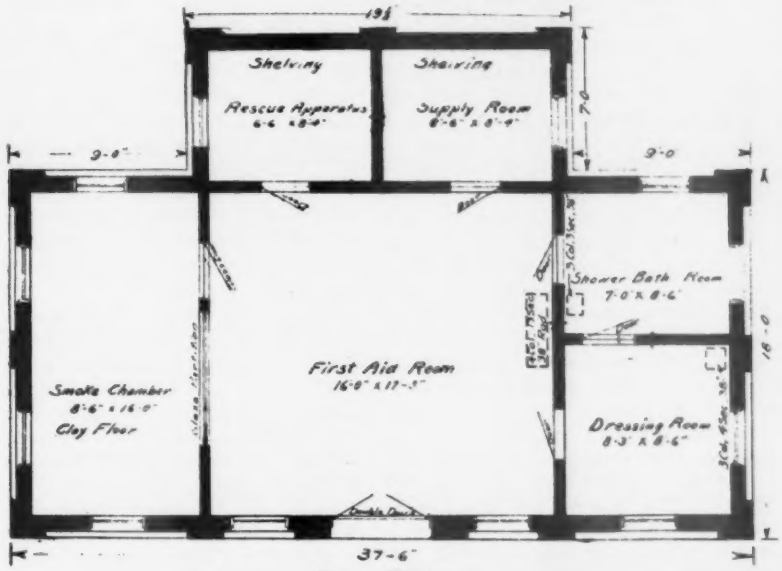
Each rescue car is fully equipped with all the small supplies, tools, etc., that are ordinarily needed when handling an underground fire, or other emergency work. The equipment consists of one complete set of track tools, together with everything needed for building brattices and hanging curtains, such as axes, saws, hammers, life line, set of timberman's tools, 10 pounds of mixed nails and a complete set of splints, including special ones for back injuries, together with a first aid cabinet, stretcher and a full supply of first aid material. All this is neatly packed in lockers under the seats along the sides of the cars. The cars are so constructed as to carry a stretcher suspended on springs, thus enabling an injured man to be comfortably transported.

Smaller chemical extinguishers, fire-hose stations, automatic sprinklers, etc., are liberally provided in the various openings around the shaft bottom, such as locomotive barns, shops, offices, waiting places for the men, etc. The extinguishers and hose are systematically assigned to certain employes for maintenance, and use in case of actual necessity.

In the various underground districts near the working faces smaller first-aid stations are provided, which contain, in large air-tight cannisters, a stretcher, wool and rubber blankets, and a full line of the smaller first-aid supplies, such as bandages, medicines, splints, etc.

Electrically insulated cars for delivery of powder underground are provided. They are wood and asbestos lined, with trucks insulated from the body of the car, preventing any possibility of explosion by an electric current. Tests made under the most severe conditions have demonstrated their complete safety.

Safety to the property itself, although not ordinarily considered as part of a general safety promotion program, nevertheless often contributes directly toward safety of life, and is deserving of consideration in any permanent safety campaign. Therefore fire protection above ground receives the same careful attention as that below. The surface at each mine is equipped with self-draining, non-freezing fire hydrants, which are served by a powerful pump devoted to this service alone, although provision is also made by suitable connection to permit any of the other pumps to be utilized for this service when necessary. Main pipe lines are installed of ample size to keep three or four lines of 3-in. hose fully supplied. Each hydrant is covered by a neat house about four feet square with wide doors, in which is kept a supply of hose, the length depending on the location of the surrounding buildings, but never less than two 50-ft. lengths of of 3-in. hose, together with nozzle and fittings. Hose wrenches are kept in each station and the hydrant wrench is fast-



Floor Plan

ened to it by a chain so that there will never be time lost hunting a wrench with which to turn the water on.

Where the older tipples and fan houses are not of fire-proof construction additional protection against fire is given by a perforated pipe sprinkling system, controlled by outside valves, which enable the complete structure to be flooded.

Much other equipment, which can only be given passing mention here, is used for promoting safe operation. This includes automatic controls on the hoisting engines to regulate the speed of hoisting and prevent over-winding, as well as detaching hooks which automatically release the cage from the rope, and suspend it under the sheave wheel when an over-wind actually occurs. Guards for shop machines, gears, belts, chains, etc., everywhere around the plant, are inexpensive and effective aids to every day safety. Guards on undercutting machines have saved many lives and limbs, electric switches that can be locked open when powder deliveries are being made, home-made fibre covers for the ordinary open switch, and split rubber hose guards for trolley wires over travelling ways, all tend to reduce electrical injuries. Each plant offers almost unlimited opportunity for the application of simple safety devices adapted to its own individual requirements.

General Methods

While guarding against major accidents by the use of special equipment, and endeavoring to prevent, or limit, explosions by rock dusting of dry workings, and in other ways attempting to prevent general disasters, all play an important part in safety work, yet, as everyone knows, by far the greatest proportion of injuries and fatalities occur

Mine No. 6—Divernon, Ill., Mine Rescue Station.

in the daily run of individual accidents. A miner is killed here by a fall of roof in his working place, a machine runner is caught there in the cutter chain of his machine, a trip-rider is squeezed elsewhere against the ribs or timbers, and so on all over the mine the casualties occur. They are so generally the direct result of individual carelessness as to make educational effort the only effective means of approaching the problem. To this end it is the company's endeavor to give all its employes as much training in mine rescue and first-aid work as it can induce them to take, feeling that this in itself will make them less prone to incur needless risks. The mine rescue stations are naturally the headquarters for all such educational work. Not only do the first-aid and mine-rescue teams use them for training and practice, but any other employes desiring to take the training are given full opportunity to do so. The company in such cases furnishes the equipment and supplies, as well as the instructor, and all that the individual has to do is take the necessary time and make an honest effort to benefit thereby. The facilities for training are so complete that it has not been unusual for the Federal and State Mining Departments to send their representatives direct to the mines, and conduct the same examinations in the mine rescue stations, and confer the same certificates, that would be given at the State and Federal stations. Practically all our supervising forces, and a great many miners, have been trained in both first-aid and mine rescue work in this way.

It has always been comparatively easy to induce the official forces to avail themselves of the opportunity to take the training, but with the other employes it has often been an altogether different matter. Their natural contempt for danger, bred through long familiarity therewith, has only too often made them indifferent to the opportunities so freely offered to train themselves along these lines. A thorough course in first-aid work however, would, of necessity, seem to keep before them the results of injuries which could so easily be received in the course of their routine work. Inspired by the feeling that universal first-aid training would make our men more careful we first attempted it on a large scale at Mines 9 and 12, located close together in Williamson County, Illinois, and employing about 1.200 men. This was the first attempt to give first-aid training on a large scale in the Illinois field. It was handled in co-operation with the State Department of Mines and Minerals, and the district station of the U. S. Bureau of Mines at Vincennes, Indiana. Our first step was to "sell" the idea to the local management of the mines that had been selected for the training. After this the idea had to be "sold" to the officials of the miners' union, as well as to the individual miners themselves. More than a year was spent in preliminary propaganda of this kind, and after favorable sentiment had thus been developed meetings of the miners were addressed by representatives of the state and federal bureaus, as well as by company officials. With no dissension of consequence the men agreed to support the movement to the fullest possible extent and arrangements were made for the actual training to get under way.

The great number of men to be trained made it necessary to conduct many classes simultaneously. Separate classes were arranged for the white and colored. The training work was handled by 45 instructors, 35 of whom were furnished by the company and the remainder by the state and federal departments. With this number of instructors available, and each mine being handled separately, it was possible to place at least two, and frequently three, with each class of 25 men, thereby assuring each and every man adequate personal attention. The interest taken by the men in the work

was surprising, and it is worthy of note, in this connection, that some of them had to spend as much as 16 hours daily away from home while the training was under way, and a few had to drive a distance of 28 miles to reach their work. For this reason the classes were started promptly at 7 p. m. so that the work each evening could be finshed not later than 9.30 p. m.

This training occupied three weeks, during which time all employes to the total of 1,246 received the training. By the experience gained in this initial effort we were later enabled to train 522 employes at another mine in much less time, and the work has been gradually extended until every operating mine now has its employes 100 percent trained in first-aid work.

The interest displayed by the local communities in these wholesale training campaigns was such that school rooms and public halls were freely made available for the many large classes, and in some places nearly 100 women and girls also took the training. Included among these women were not only many from the miners' families, but also a goodly proportion of school teachers, office employes and others from various walks of life.

The idea of working along educational lines is further developed by the supervisor of explosives and the local safety inspectors in the individual contact with the men in their working places, which their routine duties underground permit.

The supervisors of explosives are men specially skilled in shooting and blasting methods. Their efforts are concentrated toward developing, by direct instruction of the men in their working places, methods that will promote the safety of the men and at the same time improve the grade of coal produced. Only too many of the so-called skilled miners of today are notoriously inefficient when it comes to shooting down their coal, and the badly placed shots, as well as heavily overcharged ones which they almost invariably use, has undoubtedly been responsible for many a major disaster. It is the purpose of this part of the work to give individual instruction to those in most evident need of it, and by keeping a tonnage record of the coal produced per keg or case of explosives, both for individual miners as well as the groups working on each entry, develop a friendly rivalry to excel.

The local safety inspectors, as a general rule, have two mines each to cover, although in some cases one inspector will be assigned to continuous duty at a large mine when it is working steadily. Their inspection work and reports rendered in connection therewith are not permitted to relieve the local mine management of any responsibility whatever for the maintenance of safe conditions through their own daily initiative. It is surprising, however, the number of unsafe conditions that even the best supervising officials will overlook altogether in their daily contact therewith, while a special inspector, working independently, and seeing each place at less frequent intervals, will readily note for correction.

The local safety inspectors in their routine work underground cover all parts of the mine, including the working places, haulage ways, air courses, etc. The ventilation in the different sections is measured and recorded, and the condition of air courses is reported in detail. When any man is found working under dangerous conditions, not only is his attention called to it, but the matter is promptly reported to the mine manager or one of his assistants by telephone. All unsafe conditions and practices are noted down by the inspector, and discussed with the mine manager before leaving the mine, in order that he may have immediate information regarding same. Upon returning to the office the notes are put in the form of a typewritten report, copy of which goes to the mine superintendent and mine manager, with an additional copy to the general superintendent. In this way the mine superintendent is enabled to go through the report in detail with his mine manager and arrange for handling such matters as were not taken care of while the inspector was in the mine.

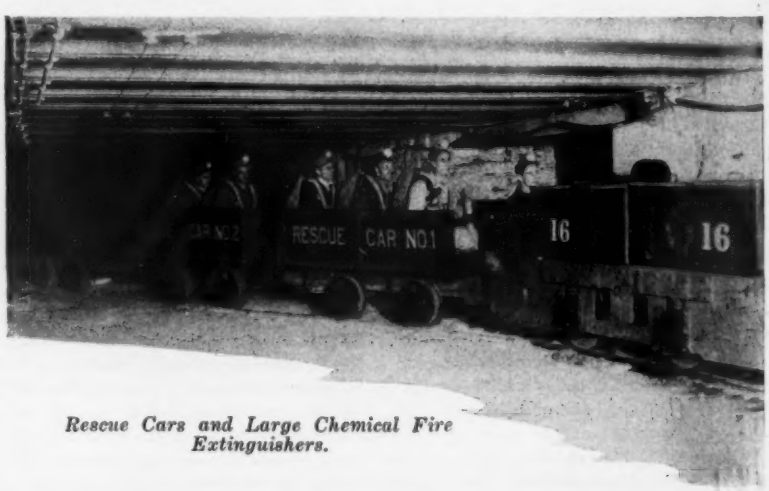
As may be readily surmised there is plenty of opportunity for friction in work of this kind, unless all concerned are sincerely moved by the same desire to promote safety and eliminate accidents. Experience has proved conclusively, however, that real team work can be quickly secured by the prompt elimination of those whose disposition is such as to make it impossible to work harmoniously with their associates.

There is regularly maintained at each mine a permanently organized mine rescue team, and frequently a second and third team is organized, any of which are available for actual service whenever needed for fighting fires underground, or rescue work in times of major catastrophes. These teams have frequently been called upon by the State Department of Mines to assist the state teams in emergencies, and have given an excellent account of themselves when working under the most difficult and dangerous conditions.

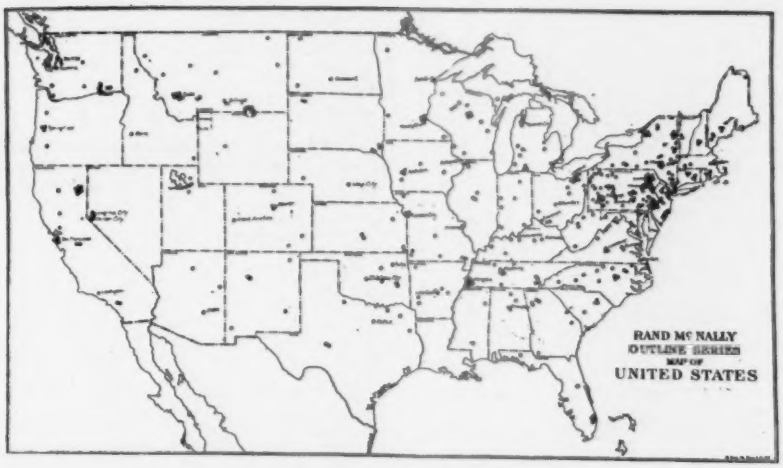
When state contests in first-aid and mine rescue work are held each mine sends a representative team. When an international contest is to be held a company contest under the supervision of outside judges selects the team that will attend. The company pays the expense involved in sending the winning teams to the contests, and much rivalry for this honor is displayed between the teams. One of these teams, entirely trained at one of the local mine rescue stations, won first prize in the International Mine Rescue contest at San Francisco in September, 1926.

The spirit of rivalry between the different mines is given further impetus by the preparation in the general safety inspector's office of comparative statistics which are sent to each mine monthly, showing how each place compares with the others as to the number of accidents, liability and compensation costs involved, tonnage produced per fatal and nonfatal accident, etc.

For the supervising officials, and those employes who display the greatest interest in the work, a course of advanced training is made available. This is given to selected classes by the representatives of the Federal Bureau of Mines, who come to the different properties and handle it in the local mine rescue stations, using for it the equipment regularly provided at each mine. This comprises a more (*Continued on page* 342)



Rescue Cars and Large Chemical Fire Extinguishers.



This map of United States shows the frequency of these accidents. It will be seen that a great majority of the accidents took place east of the Mississippi. Pennsylvania leads all the states in the number of accidents and New York is next.

REDUCING ACCIDENTS DUE *to* CARELESS HANDLING *of* BLASTING CAPS

By F. J. BYRNE *

Approximately Five Hundred Children Injured Annually From Playing With Blasting Caps—Active Campaign Initiated Two Years Ago To Eliminate This Hazard Shows Cooperative Spirit And A Lessening Of Accidents

THE campaign to reduce accidents to children from playing with blasting caps, with which most mining men are familiar, is now two years old. According to the most recent graph prepared, covering the month of January last and a part of February, it would seem that there has been a lessening in the number of children hurt. It is too early to say whether this indicates a permanent reduction in the accident rate, due to the persistent efforts to warn parents and children, or whether it is merely a casual lessening due to unknown causes. At any rate, it would seem logical to suppose that a country-wide campaign which has been carried on with the help of many agencies and industrial companies should begin to bear fruit.

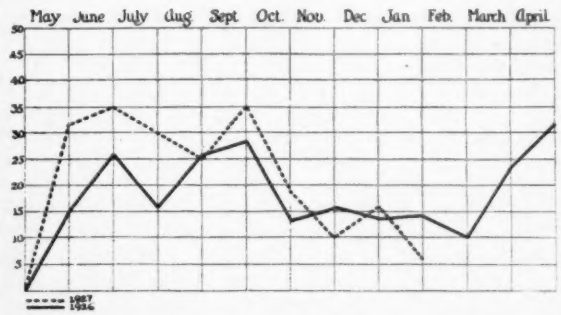
Progressive mining companies, have long taken an active interest in preventing the careless throwing about or carrying about of blasting caps, and explosives companies also have continually sought to point out the danger to children and others unless some measures were taken to see that these objects were properly stored when not in use. The full significance of the total number of accidents occurring was not brought forcibly to the attention of the mining and other industries interested and to the public at large until two years ago. At that time, Mr. Arthur La Motte, manager of the technical section of the du Pont Company and chairman of a subcommittee of the Institute of Makers of Explosives initiated an inquiry into the total number of such accidents occurring in the country at large as shown by newspaper reports and reports from explosives companies. Before that, Mr. La Motte had written from time to time on the subject and had also helped in an essay contest among school children, which was designed to point out the danger. Other explosives companies had also been active in the work.

As a result of the survey made, it was learned that there are about 500 children injured in the United States each year from playing with blasting caps. These objects are picked up when they have been carelessly left by workmen and others. Accidents have occurred in the mining districts, in and around quarries and in the rural sections where blasting and road work are being done. According to the data in hand, it would seem that a majority of the accidents take place in rural or semi-rural districts.

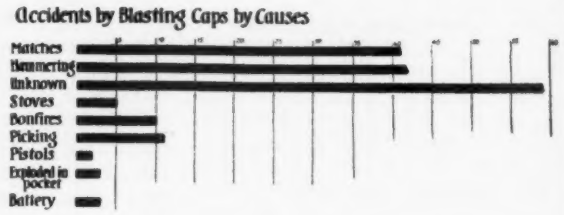
When it was established that so many children were being injured, and some of them killed each year from this cause, the matter was taken up by the Institute of Makers of Explosives, an organization which represents most of the explosives manufacturing companies of the United States. Literature, consisting of a poster and a pamphlet, was prepared and all proper agencies were invited to cooperate in the movement to reduce these accidents. There has been splendid cooperation in the work from the school authorities in nearly every state in the union, from the Bureau of Mines, the Surgeon General of the Treasury Department, the National Safety Council, the Department of Agriculture, the Alabama Mining Institute and the mining institute of the State of Washington, and other bodies.

The matter is one of grave concern for the mining, quarrying, contracting and all other industries which use explosives. There is more than the usual responsibility because blasting caps are in themselves dangerous objects in the hands of children and their playing with them results almost invariably in tragedy. Most of the children who are hurt are from eight to twelve years old, and some even younger. Great numbers of the children have no conception of what a blasting cap is and when they find one regard it as a pretty plaything. This was evi-

* Institute of Makers of Explosives.



The solid line in the graph shows the accidents which began in May, 1926, and run through to April, 1927. The dotted line shows the number of accidents beginning in May, 1927, and continuing up to the end of January, 1928. It is the belief that the large number of accidents shown in the spring and summer months is due to the fact that the children are out of school and have more time to play in the open. The lessening of accidents during the fall and winter is due, it is believed, to the fact that the children are not playing so much out-of-doors. At the present time, the graph shows a decrease over the corresponding period of last year.



It is interesting to note that attempting to light caps with matches, and hammering by children cause most of the accidents, as far as it is possible to identify them by causes. The unknown causes rank first, as it is not always possible to find out how the accidents occur, the children sometimes not remembering what happened or being unwilling to tell.

denced by an accident which occurred in California where a mother left her seven year old daughter playing on the front porch with her dolls while the mother was busy in the rear of the home. There was a loud report, but the mother at first paid no attention to it thinking it was an automobile exhaust. When she heard her daughter scream she ran to the front porch and found the little girl so badly injured that some of her fingers had to be amputated and her sight was destroyed. Someone had dropped or thrown a blasting cap in the road in front of the house and the little girl found it. When she tried to pick at it with a needle, the tragedy resulted. Some of the larger children know what the blasting caps are for but try to set them off for fun.

It is interesting to note how these accidents are caused. Hammering comes first, then lighting with matches, picking, throwing caps in bonfires and stoves, attaching caps to batteries, exploding in pocket and endeavoring to put caps in pistols. The graph printed herewith giving these causes shows the greatest single number under "unknown." Often the child can't tell what happened, the shock being probably such that all recollection vanishes.

In its pamphlet, the Institute of Makers of Explosives points out that "Blasting caps contain fulminate of mercury, a quick, powerful explosive. It is readily exploded. It will explode when struck by a hammer. The blasting cap will explode when thrown into the fire. It will also explode when children try to extract the contents with a pin, or by holding a lighted match to it, or by thrusting the flaming end of the match into the cap. In the mines and quarries, even, where the men who have to use blasting caps every day ought to know better, there are plenty of mangled hands and other injuries as the result of crimping caps on fuse with a jack-knife, pointed nail, or any tool that's handy. Many a miner has crippled himself for life in biting the cap on the fuse, and others have filled themselves with copper or have been killed outright by the sparks from their hat lamps or pipes dropping in an open box of caps. Lots of blasters continue to bite the cap on the fuse and think that because they have never exploded them they never will; but some day they will bite the business end and lose something besides teeth. It is much easier, and lots safer, to use a crimper, a tool made for the purpose. Accidentally stepping on a cap will often result in a mangled foot. Sparks, flame, heat, blows, friction—all serve to explode the cap to which they are applied.

"A blasting cap is a copper shell about a quarter of an inch in diameter and an inch or two long, half full of fulminate of mercury. This fulminate is the most sensitive and about the most impulsive explosive in common use. Blasting caps contain anywhere from 15 to 30 grains of it; primers for firearms cartridges usually contain not more than one-fifth grain. That's what the hammer or firing pin of a gun or pistol hits to ignite the powder in the shell. A blasting cap is meant to work the other way. The powder from the fuse ignites the fulminate in the blasting cap, and it explodes with terrific force and detonates the dynamite. The explosion of the fulminate is so exceedingly quick that the flying particles of copper will embed themselves in iron a foot away. They will blow a hole clean through a steel plate one-sixteenth of an inch thick. A box of caps will blow a hole right through a 2-in. oak plank. One cap will blow a child's hand off. Lingg, one of the Chicago anarchists, committed suicide by biting a blasting cap between his teeth."

The map shown on this page indicates the distribution of these accidents by states. Each dot represents a child hurt or killed, and the dots are placed as near as possible to the locality indicated in the reports.

In its efforts to make clear to all those interested in the dangers of playing with blasting caps, the Institute of Makers of Explosives turned over to its Technical Committee the work of redrafting in even stronger terms the warnings which are placed on the boxes of blasting caps. In addition to the pamphlet and poster referred to, it had made a one-reel motion picture, printed on safety stock so that it can be shown anywhere, telling a story for boys and girls on the dangers of playing with blasting caps. This film is entitled "How Jimmy Won the Game," and the story is based on a baseball game and how the star pitcher was saved from being injured because one of the boys knew the dangers of blasting caps. The film is regarded by competent authorities as one of the best safety pictures made.

There is, of course, a community of interest among (*Continued on page* 342)

SAFETY WORK *at* UNITED VERDE

By W. V. De Camp*

Safety Engineer, Regular Safety Meetings, Standardized Methods Of Doing Work, Special Training In First Aid, And Definite Rules And Regulations Part Of Safety Work At The United Verde Copper Company—Penalty System For Infraction Of Rules Employed—Education Of All Men In Safety Measures Imperative

THE safety program conducted by the mining department of the United Verde Copper Co. begins in the employment department. This department is headed by an employment and welfare agent, who has an assistant thoroughly conversant with Spanish, and necessarily so, due to the large number of Spanish-speaking employes in our service. The employment department endeavors first to eliminate all new men who have had no experience in mining, and in conjunction with the foremen and bosses of the various departments they arrange for transferring men from one department to the other, since we feel that the longer the service record of an employe becomes the more inclined he will be toward generally safe practices.

Following the engagement of an employe, he is advised as to the definite schedule he is to follow, particularly with reference to safety precautions. When appearing before his boss or foreman, the latter has received instructions to place this new employe, whenever possible, with an older man who has had experience in the particular line of work undertaken.

Every employe when entering the service of the company is supplied at cost with a first-aid packet containing a tourniquet and head bandage. When this packet is used, he returns the empty container and receives a new one without charge.

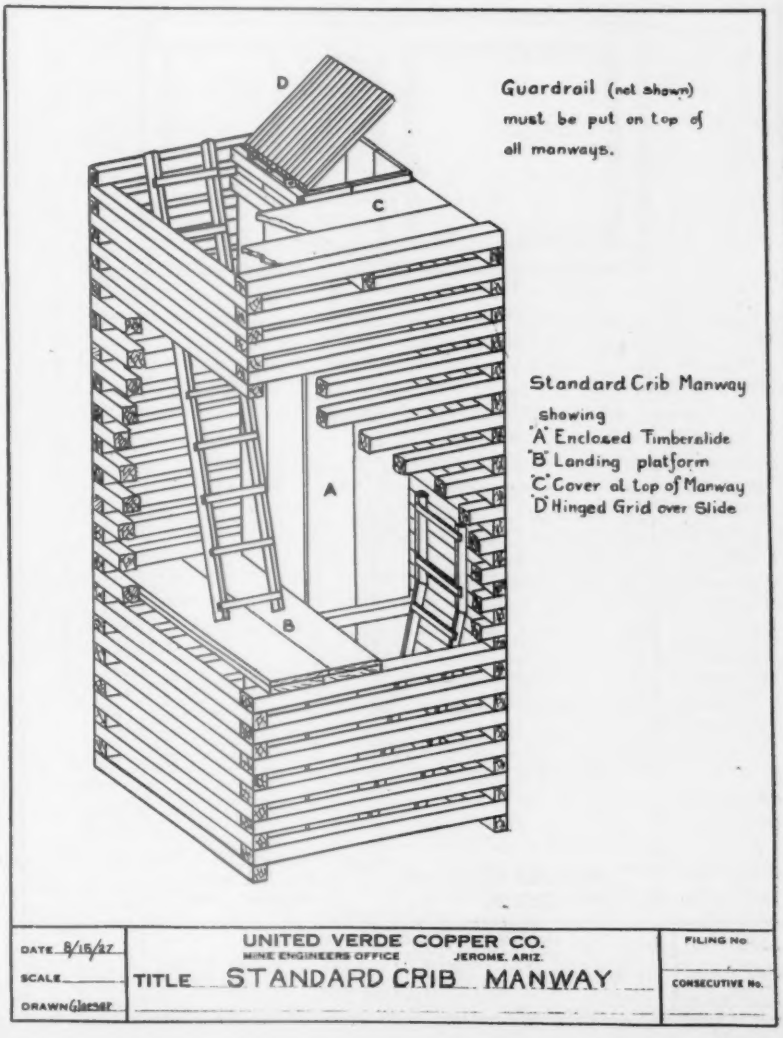
In every section of the mine and plant there are men available who have been thoroughly trained in first-aid work, the object of this work being purely one of getting the injured man to the hospital in a sanitary condition, or if he has a broken bone, with the member properly strapped to prevent movement. Men in the various sections of the mine are trained at regular intervals in first-aid work, and in several years of operation we have had no one go to the hospital who has not been given proper first-aid treatment.

At the mine plant there is a chief safety engineer with an American and a Mexican assistant. The department is equipped with an inhalator and 12 Gibbs apparatus for fire work. This apparatus, due to the arid climate, is stored in retainers where a definite humidity is maintained to prevent destruction of the rubber parts.

A group of 30 men, who are constantly on call and whose working location is indicated on a call board, daily are used for fire work. They are thoroughly trained in the use of the Gibbs helmet, and their training is repeated at regular intervals in order that they become familiar with conditions in the mine and the use of the equipment. For this work they receive 25 cents per day above the standard scale in their particular classification.

Definite rules and regulations as regards type of clothing that must be worn, condition of equipment, and general working methods are supplied and all men are instructed therein.

The penalty system is in use for infraction of rules and is found absolutely necessary, since many men will not accept safety regulations unless they realize that a penalty will be demanded of them for infractions.



* General Mine Superintendent, United Verde Copper Co., Jeroe, Ariz.

Goggles are in universal use throughout the surface plants as well as underground; also hard-toed shoes where there is a possibility of injury to the toes, and the enforced use of gloves is adopted where hand work is particularly hazardous.

Methods of doing work are standardized in so far as possible. This applies to ventilation, methods of handling powder, use of machines, interval of time required for blasting, and many other requirements. Working places are designated by numbers and letters, and the direction of exits plainly marked. Many other safeguards, such as guards on cars and motor trolleys and guards over openings are a part of regular equipment. Within the mine safety stations are established on every level equipped with wire stretchers and blankets in addition to first-aid equipment.

A definite schedule is employed for obtaining assistance from the hospital whenever an accident occurs direct through one channel to insure the prompt arrival of the ambulance and the greatest possible dispatch in delivering the patient to the hospital. For this purpose each level of the mine is equipped with telephones, and in some cases two phones on a level when distances are great.

Regular safety meetings are held and everyone maintains an interest in this work from the general manager to the lowest-paid employe. These meetings are augmented by first-aid and safety talks, and are generally given to the men in small groups on the various levels of the mine or on the surface. Our company is a member of the National Safety Council and uses a great many of their safety posters throughout the mine and plant. In general, we feel that for proper safety conditions the following points should be kept constantly in mind by the entire organization:

(1) Education of all men in safety measures is absolutely essential, and even more so than the elimination of the hazardous condition by means of some type of equipment. This education should be directed to personal safety as well as safety for others, and should start with the manager and continue down through the bossing organization to each employe. Care must be exercised in employing men, first as to their eligibility for the work in hand, and, secondly, only after a careful physical examination. Age limits should be strictly adhered to, both minimum and maximum, and in addition extreme caution should be used when it is necessary to employ a large number of men in a short period.

(2) In a mine of this type, active rescue work should be maintained, in addition to which certain numbers of men should be thoroughly trained in established first-aid practices.

(3) A clean and well-lighted and well-ventilated working place is absolutely essential for proper working conditions, and this can only be obtained by proper inspection on the part of officials and proper training of the men.

(4) Considerable imagination is necessary on the part of men directing safety propaganda if this work is to be effective, since the constant repetition of the same program eventually becomes so tiresome that little or no attention is given it, with the result that men well trained at one time may become lax and careless unless the propaganda and program for safety is varied sufficiently to keep them interested.

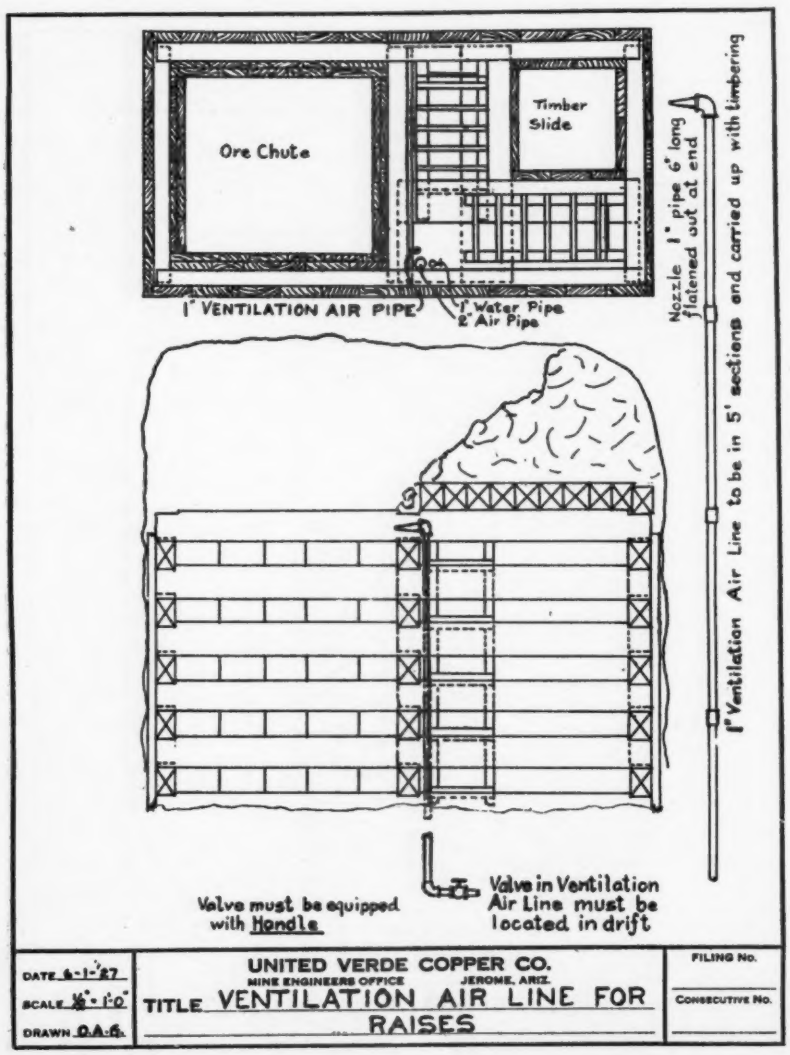
(5) The penalty system for improper safety precautions on the part of employes and a bonus system for elimination of accidents on the part of foremen and bosses are considered essential.

(6) Proper equipment must be installed and inspection of working places and working conditions be performed at regular intervals. When this can be done by committees of employes as well as by the safety inspector it becomes even more valuable.

(7) Publicity of safety records of individual bosses and detailed publicity regarding every accident is essential for the proper education of both bosses and men.

(8) Competitive safety programs between departments are extremely valuable in creating interest among those concerned.

Safety methods and safety propaganda have been constantly employed at this property for many years, and the best criterion of the results is the safety record, which indicates that today, after seven years of constant work, we have a serious-accident (two weeks' duration) rating of approximately 2.0 per 10,000 shifts as compared with a rating of 4.5 during the earlier stages of this period.


Ore Chute
Timber Slide
1" VENTILATION AIR PIPE
1" Water Pipe
2" Air Pipe
Nozzle 1" pipe 6' long flatened out at end
1" Ventilation Air Line to be in 5' sections and carried up with timbering
Valve must be equipped with Handle
Valve in Ventilation Air Line must be located in drift
DATE 6-1-'27
SCALE ½" = 1'-0"
DRAWN O.A.G.
UNITED VERDE COPPER CO.
MINE ENGINEERS OFFICE JEROME, ARIZ.
TITLE VENTILATION AIR LINE FOR RAISES
FILING NO.
CONSECUTIVE NO.

THE TUNGSTEN INDUSTRY

By Nelson Franklin *

Only Method By Which Tungsten Production May Be Increased In United States Is By Higher Tariff Than Industry Now Has —Domestic Production, Importations, And Sources Of Imports Outlined

DURING the World War the demand for tungsten became so great that the resources of the world were combed, and during 1915 and 1916 the price exceeded by nearly tenfold the price of today.

Prior to the World War the great value of tungsten as an alloying metal was not fully understood or appreciated.

Resources

The first discovery of Tungsten in the United States was in 1900 in Boulder County, Colo. In 1908 it was found in California at Atolia. During the war extensive deposits were found at Bishop, Calif., in several localities in Nevada and Arizona and smaller deposits in other states.

World Production

There are no records of world production prior to 1906, when it reached 4,400 tons of 60 percent WO_3 (tungstic trioxide) concentrate. The production gradually increased up to 1915, when it exceeded 12,000 tons; in 1916, 23,000 tons; in 1917, over 27,000 tons; and in 1918, the last year of the war, the world production exceeded 36,000 tons of 60 percent WO_3 concentrate.

Domestic Production

The domestic production from a few hundred tons in 1900 gradually increased to 2,300 tons of 60 per cent WO_3 concentrate in 1915. The domestic production reached 5,900 tons in 1916, 6,100 tons in 1917, and, up to November, 1918, at the close of the war, the same ratio of production was maintained.

Importations

We imported little tungsten until 1912, when the figures showed 1,500 tons for that year, increased to 4,000 tons in 1916, to 5,000 tons in 1917, and in 1918 to over 11,000 tons. The importations in 1918, however, were not all consumed, as a very large quantity came into the country from China between November 11 (Armistice Day) and the close of the year.

Source of Imports

Up to within a few months of the close of the war, imports were principally from South America, with very little from China, but a vast field of Wolframite was discovered in 1918 in China, covering hundreds of miles in extent, where the ore is high-grade tungstic trioxide content recovered from the surface as float from the erosion of the veins, which means a very low production cost even for China.

Cessation of Domestic Production

At the close of the war domestic production entirely ceased, owing to large stocks of Chinese ore then in the country and en route here from the newly discovered deposits in China and brought in at a cost with which the domestic producers could not compete.

At this time there was no tariff on tungsten ore imports.

Tariff Act of 1922

In the tariff act of 1922 a tariff of 45 cents per pound of metallic tungsten content was provided, which is equal to $7.14 per unit (20 pounds) of tungstic trioxide content, which is the form in which tungsten occurs in ore. Congress, when considering the tariff act was asked to place the duty at $10 per unit of tungstic trioxide, but it was finally fixed at $7.14, which has since been proven to have been insufficient to produce domestic tungsten from even the lowest production cost mines and compete with China, where all the importations now originate, with the exception of very small tonnages from Burma and Malaya, the production of which countries goes mostly to the United Kingdom and Germany.

It being impossible to produce tungsten in this country after the war without a tariff on imports, the same condition existed after the tariff act of 1922 up to 1925, owing to the large stocks in the country brought in prior to the passage of the tariff act.

In 1925 those stocks were sufficiently depleted to allow the stocks of imported ore still on hand to be held at higher prices, but only high enough to permit of the resumption of operations on a small scale by the very lowest cost production mines.

During the year 1925 these few low cost producing mines could operate at a small margin of profit, and produced about one-third of the total consumption of the United States, which averages in peace times about 3,500 tons of 60 percent WO_3 (tungstic trioxide) per year.

During 1926 the cost of Chinese ore was lowered and the price obtained from domestic consumers was reduced to a point where the few domestic producers were forced to operate without profit.

The domestic producers, however, continued operations through 1927 with the thought that the internal troubles in China would cause a diminution of exports from that country, but this condition was not realized, in fact the price for Chinese ore was still further reduced and the domestic producers in their operations suffered a loss.

The only way by which the production of tungsten in the United States can be maintained and increased is by a higher tariff than that now in effect.

The domestic producers now have an application pending before the United States Tariff Commission asking for a 50 percent increase under the flexible provision of the Tariff Act, Section 315, through which, when the production costs at home and abroad are determined by the commission, will justify the increase asked for and the domestic production of tungsten can be continued if the increase is granted; and if not granted, domestic production of tungsten must cease.

* Washington, D. C.

Howard I. Young
Treasurer; Director; Chairman, Finance Committee

Arthur E. Bendelari
Past President and Director

Jesse G. Starr
Past President and Director

F. C. Wallower
Past President and Director

A. P. Cobb
Past President and Director

Percy B. Butler
Director

The WORK *of the* AMERICAN ZINC INSTITUTE

By STEPHEN S. TUTHILL *

The Institute Is One Of The More Recent Additions To The National Organization Group, Being Organized In 1918—Its Function Is The Establishment Of Cooperative Effort In The Zinc Industry

Eugene H. Wolff
Past President and Director

THE American Zinc Institute was organized in 1918 to afford the members of the American zinc industry the opportunity to exchange ideas, experiences, and vital information, to the end that such cooperative effort might redound to the advantage of all branches of the zinc industry. Thus functioning through its standing and special committees and its board of directors, the Institute has continuously served as the lookout, promoter, and defender of the interests of one of America's important key industries.

In 1919 was established the monthly slab zinc statistical service of the Institute, covering production, shipments, and stocks of slab zinc and the number of operating reports; later there was added export datum. In March, 1927, this service was extended to a semimonthly one, and at that time the tonnages of slab zinc sold but not yet delivered was also included; in June of the same year the Institute inaugurated a semimonthly publication of the weighted average selling price of prime western and brass special zinc, spot and forward, together with tonnages. In addition, a monthly survey of world zinc conditions, by the London correspondent of the Institute, is widely published by the press.

These enlarged semimonthly slab zinc statistics, this monthly world survey of zinc, and the Joplin-Miami District zinc ore statistics, published weekly by the Tri-State Zinc and Lead Ore Producers Association, give the United States zinc industry as complete a picture of immediate past conditions as is possessed by any other large industry in this country.

Ralph M. Roosevelt
President and Director, American Zinc Institute

Stephen S. Tuthill
Secretary, American Zinc Institute

The policy of the American Zinc Institute is to cooperate with every organization, governmental or otherwise, which may advance the interests of the zinc industry. At the moment the Institute is assisting the Bureau of Standards in compiling a letter circular on zinc, similar to those on copper, nickel, and aluminum already published by the bureau.

Ready for the press is "Zinc and Its Corrosion Resistance," an authoritative exposition of the subject.

Recently returned from Europe is the representative of the Institute, who has been abroad for the purpose of obtaining necessary data for the completion of a zinc manual for the use of architects and artisans.

The Institute is joint sponsor with the A. S. T. M. of the A. E. S. C. Committee on the International Standardization of Slab and Rolled Zinc, which has just emitted tentative speculations for rolled zinc.

* Secretary, American Zinc Institute, New York, N. Y.

The secretary of the Institute is the secretary of the A. E. S. C. Committee on Specifications for Zinc Coating of Iron and Steel, of which the A. S. T. M. is sponsor.

The work of this latter Sectional Committee covers the entire field of zinc coating (galvanizing); each of its six technical committees is rapidly laying the foundation for standard zinc coating practice in its particular division.

This matter of adequate zinc coatings is one that the Institute has long advocated, and the work of this Sectional Committee will doubtless do much toward improving the quality of all zinc-coated material.

In this movement for better zinc coatings is joined the Sheet Steel Trade Extension Committee, whose activities are well known through its publicity and advertising.

The Bulletin of the Institute, established in 1918, is the only publicly circulated all-zinc publication in the world. Not only has it recorded zinc mining and metallurgical comments and developments throughout the world for the past decade but it has also modestly set forth the activities of the Institute on behalf of the domestic zinc industry during the life of the organization.

A series of publicity articles dealing with the various uses of zinc is now in course of publication.

Each year the secretary of the Institute contributes, as most secretaries are called upon to do, talks and articles on zinc and its products.

The headquarters of the Institute has become a world clearing house for zinc information.

The annual meeting of the Institute, generally held at St. Louis, and usually in April, is attended by men from all parts of the world who are directly or indirectly interested in the zinc industry. These annual meetings, together with the willingness of the Institute to serve the industry in the interim at every possible point, has engendered a mutuality of understanding among the several branches of the zinc industry which at the outset was believed by many to be impossible.

AMERICAN ZINC INSTITUTE HOLDS TENTH ANNUAL MEETING

RALPH M. ROOSEVELT, of New York, vice president of the Eagle-Picher Lead Company was elected president of the American Zinc Institute at a meeting of the Board of Directors, April 18, at St. Louis, Mo., where the Institute held its tenth annual meeting, April 16, 17 and 18. Mr. Roosevelt succeeds Jesse G. Starr, of Joplin, who declined re-election, but who automatically becomes first vice president. P. B. Butler, of Joplin, was elected a vice president, and John A. McCarthy, of New York, was re-elected. The retiring vice presidents are A. P. Cobb, of New Jersey Zinc Co., and Julius W. Hegeler, of Danville, Ill. Stephen S. Tuthill, of New York, who has been secretary of the Institute since its organization 10 years ago, was re-elected, as was Howard I. Young, of Mascot, Tenn., who has served as treasurer for 10 years. There was only one change in the board of directors, Edgar L. Newhouse, Jr., of New York, succeeding Alexander J. McKay, of La Salle, Ill., who resigned.

An important step taken by the Board of Directors was to amend the by-laws of the Institute so as to increase the powers of the executive committee, and to make the organization of the Institute comparable to that of large industrial corporations.

P. B. Butler, at the opening session proposed combining the American Zinc Institute with the lead institute as a means of increasing its effectiveness and usefulness to the members. He said, "Our institute is now 10 years old, and I am the last one to suggest that our childhood has been in vain, but I do not think we have grown as we should. Our membership, due to the fact that our aims, perhaps, have been restricted to those interested only in the Tri-State district and the retort smelters treating our ores, has remained almost stationary. Our viewpoint has been correspondingly restricted. With lead in our institution we will not only strengthen our membership and widen our aims and goal, but at the same time we, ourselves, will be able to establish contact with an industry that is indissolubly related to ours, which would, I believe, open up vistas that can hardly be imagined."

Increased research was advocated as a means of increasing the benefits of the institute by N. P. Rood, W. T. Landrum, P. W. George and H. W. Rossman. Following these discussions, the members by a rising vote, expressed themselves as satisfied with the work that the institute had done and also that of trade association department of the United States Chamber of Commerce.

Hugh P. Baker of Washington, D. C., in an address, "What's Ahead of the Trade Association?" turned his address into the general trend of the meeting, and made an effective sales speech, the object of which was to sell the trade association idea to its members. He defined the trade association as an organization devoted to mutual helpful service and better business.

Probably as important a session as the American Zinc Institute has ever held was that of April 17, when the subject of zinc coating or "galvanizing," as it is more commonly known, was discussed. For the first time several of the larger galvanizing concerns of the country had accepted invitations to send representatives to meet with representatives of other branches of the zinc industry under the auspices of the Institute. The session was presided over by F. G. Wallover, of Joplin, chairman of the Institute's galvanizing committee. One of the principal addresses was delivered by H. S. Rogers, of the Sheet Steel Trade Extension Committee, on the subject of "Brothers-In-Law in Business."

The institute was scored for its failure to assist the sheet steel extension committee in a financial way in its efforts to increase the use of zinc coated sheets, by Mr. Rogers, of the steel committee. He said the institute had caused a "breach of promise" because of its failure to assist financially, after promising to do so at the 1927 annual meeting of the institute.

The zinc industry, at that meeting, tentatively agreed to raise between $15,000 and $25,000 to give to the committee, but so far the steel committee has received only $1,645.

Mr. Rogers outlined the many developments the committee has made to increase the use of zinc coated sheets. These efforts were bearing fruit, he said.

The Institute's annual dinner was held the evening of April 18, with Capt. Irving O'Hay, of New York, as the principal speaker.

Greater cooperation between the producers of zinc in the West and Middle West was suggested at the last day's session. The object is to obtain an equitable curtailment of production in all sections, instead of putting the burden of rectifying the unbalanced law of supply and demand entirely upon the shoulders of the producers of the Joplin district, and the retort smelters using that ore.

The suggestion came during the discussion of a paper, "Past and Present Production in Zinc West of the Mississippi River, and to What Extent the Recent Improvement in Flotation Affected the Same," read by Howard I. Young.

The paper estimated the electrolytic production of the west for the present year as being at the rate of close to 200,000 tons a year.

The greater portion of the last day's meeting was devoted to technical articles and a round table discussion under the auspices of the United States Bureau of Mines, at which A. C. Fieldner, of the bureau, presided.

PROMOTING *and* DEFENDING CALIFORNIA'S MINERAL INDUSTRIES

By J. M. FRIEDLANDER *

Eagle Shawmut mill across Tuolumne River.

The Work Of The State Corporation Department Of California In Applying The Blue-Sky Law To The Mining Industries, And The Attitude Of The Department To The Industry, Outlined

WHILE searching about for new material for use in what newspapermen refer to as a "lead" for this article, the chief engineer of this, the State Corporation Department, placed before me the report of his division covering the six months period September 1, 1927, to February 29, 1928. "This," I mused, "must contain what I am looking for, and if it meets the wishes of the editor of THE MINING CONGRESS JOURNAL, who has asked me for an article on the activities of the department, with particular reference to the mining and oil industry of California, well and good. If not, he has my consent to use his blue pencil and substitute some other portion of the article that strikes his fancy."

The report is filled with statistics, which I have read pridefully, because they tell something a Californian always likes to hear and talk about—the greatness of the state in which he lives. These statistics relate exclusively to mining and oil. They show that during the six months period 107 new companies, organized to engage in these industries, obtained permits from this department to finance their enterprises. The aggregate capitalization of these companies was more than $54,000,000, and the shares they were permitted to issue aggregated in par value approximately $50,600,000.

I learn that complete figures on production values for 1927 have not been compiled, but some idea of the great mineral wealth of the state may be gained from those of the preceding year. In 1926 California yielded $450,000,000 of mineral products. Again referring to the report of the engineering division, I find that for the year 1927 there was a production of 230,751,000 barrels of crude oil, or nearly 7,000,000 more than in 1926. Gold produced in the state in 1927 was valued at $11,711,800, or $1,800,000 more than the combined total of the other mining states of Colorado, Nevada, Montana, and Idaho.

Naturally, in the minds of some persons, the questions arise, "What is being done in the way of supervising the concerns which are producing such great wealth? How do they obtain the money for the development of their projects? Is the investing public supplying these funds? If so, what restrictions are imposed upon these companies and their promoters that will afford some measure of protection in enterprises which, owing to their character, must be regarded as more than ordinarily speculative?"

Before attempting to reply to these questions, I want to say that it is my earnest belief that mining should be encouraged to the utmost, despite the exceptionally large element of chance connected with its development. Men who are ready and willing to undergo the hardships and to stake their own time and resources in a sincere hope of bringing wealth to themselves and those associated with them and of producing something that will benefit mankind generally, should be heartened and stimulated, not retarded. What we of this department desire is that everyone coming before us with projects be fair and square in their statements. To such persons every encouragement is being given, whether in the way of promotion stock for their property or services or in the commission that must be allowed if they hope successfully to finance their plans. Blue Sky laws were not made to hamper or hinder but to encourage persons engaged in legitimate business, while providing a control over those persons who attempt to engage in doubtful practice.

A study of the Blue Sky law of California which bears the title "Corporate Securities Act," together with the rules adopted by the commissioner under the authority given him by that law, will, I believe, convince any unprejudiced persons that much is being done in the way of supervising and regulating the mineral producing enterprises in this state. By supervision and regulation I do not mean that the state has adopted a paternalistic attitude toward mining or other business ventures. Such an attitude would be pernicious. As I have stated before, this department desires that everyone coming before it be frank and square in their statements. The rules of the department are merely the medium through which information is obtained and in the giving of which, as I have said, we desire that applicants shall—to use a characteristic American phrase—lay their cards on the table.

The rules of the department were prepared as the result of long and careful study of conditions they were made to meet. They have been added to from time to time and still are being extended as circumstances arise. Their purpose is twofold,—encouragement of legitimate business enterprise and protection to the investor against fraud. These rules are too voluminous to permit their being discussed in detail in this article. They provide among other things that an applicant company seeking a permit to sell and issue its securities must lay all its plans before the commissioner. Persons who have expended time and money in advancing the interests of an enterprise or who are transferring property to the company they have organized are amply protected in their property rights

* Commissioner of Corporations, State of California.

by the issuance to them of promotion stock, while other stockholders are protected from the fact that the amount of this promotion stock shall not exceed 50 percent of the par value permitted to be issued.

The department requires appraisals by appraisers whom it approves in the case of property transferred to a company in exchange for securities or where the property is to be security for a bond issue. In the sale of stock to the public by a company proposing to finance in such a manner, it is required that sufficient funds must be impounded to enable the company to carry out its business plans, thus removing the danger that stock sales proceeds will be frittered away in small sums.

Among the most recent regulations adopted is one requiring companies obtaining permits to appoint and maintain transfer agents in order that every share of stock issued may be traced from date of its issuance. Another rule requires companies to have registrars, the purpose being to prevent over issue of their securities. Still another requires companies receiving permits to make a report as to their financial condition at stated times, so that the department may be advised of their status, particularly in their initial stages.

The department has fixed 20 percent as the amount of commission a company may be allowed in selling its securities. While, to my mind, this amount is sufficient in most cases and too high in others, I have at times questioned whether we would not be warranted in discriminating between industrial projects and mining ventures. This question now is being considered by a committee of the State Bar of California which is studying the entire Blue Sky law for the purpose of recommending changes therein. The committee is composed of eminent lawyers and I have no doubt that any recommendations it makes will be for the best interests of all concerned.

A collateral matter being considered by the committee has to do with a question which now is before Congress, namely, whether or not the Blue Sky law of the states should be replaced by a Federal law having the same objectives.

At the time the committee was appointed I laid before it numerous comments and suggestions. These included my views relative to the adoption of a Federal corporate securities act, and as I have found no occasion to change my opinions, I believe it entirely proper to repeat them here in the exact wording they were given to the committee:

"The question frequently arises whether Federal control of corporations would be more effective than the present supervision by the state. To remove barriers, such as evasions and subterfuges in the many projects that are concealed under the cloak of the interstate commerce, would evidently seem more effective through Federal legislation than that by each and every separate state. Federal control apparently would prevent promoters from going shopping for loose and cheap places to incorporate. It would have a tendency to eliminate competition between one state and another bidding against each other for the business of incorporation of companies. It would frustrate the possibility on the part of one state of holding out greater inducements, such as smaller fees, easier laws and more exemptions and exceptions, for companies to incorporate within its boundaries rather than another. Many projects are incorporated for these reasons under the laws of a foreign state and come back into the state to do business as a foreign corporation and as such produce a number of problems. Of course it is necessary before Federal control can be initiated to amend the organic laws of every state in the Union and it even would be necessary to add some enabling provision to the Federal constitution. That in itself involves a stupendous task. State lines are fast being obliterated. Distances that formerly existed have been wiped out and California is closer to New York than ever before and in a short time even that distance will be minimized. Whether it will be

J. M. Friedlander

Federal control of corporations or a uniform Corporate Securities Act, it is obvious that a great many difficulties that are contended with at present will some time be obviated and averted. The only other difficulty that presents itself to Federal legislation, in addition to those that are already pointed out, is that it might take an unusually long time and perhaps great expense for a corporation to qualify.

"The enforcement of Federal legislation, as a matter of common knowledge, is dilatory. Delays are not conductive to progress and if such obstacles could be disposed of no doubt Federal control would make some noticeable strides in solving the problems that are created by dealing with corporate securities. Although in that direction lies a probable solution, it is, I dare say, yet premature."

In the early days of California it was the custom for the prospector to journey to the settlement nearest the scene of his hard rock or placer activities. He called upon the owner of the general store and there he made his sales talk. If he was convincing, the store owner became an investor. The miner was grubstaked, and, in lieu of the attractive stock certificates of present day finance, the store owner received the prospector's word that the two would share equally in any proceeds of the explorer's toil. His burro loaded with bacon, hardtack, sourdough ingredients, tobacco and hardware, the prospector departed. Western history is replete with the stories of the successes made by these searchers for hidden wealth. Sometimes they failed, but were never discouraged in their belief that some day they would find the pot of gold at the end of the rainbow.

The lure of gold and other precious metals became stronger with the passing of years, and men, prompted by the gambling spirit which is inherent in the best of us, willingly invested their money in mining enterprises. The prospector who had sought assistance from the owner of the general store was replaced by the promoter who appealed to the general public. Many of them were honorable men. Some, actuated by selfish motives, engaged in swindling operations, eager investors becoming easy prey. The activities of the crooked promoter widened into other branches of business until oil was discovered, when they became rampant.

A public, severely hurt and still in danger, called aloud to be shielded, the cry coming not alone from investors but from business interests. Even honest endeavor became regarded with suspicion. Legitimate mining, whether for the yellow metal, which drew a populace to the Golden State in '49, or for the black gold which was developed in more recent years, quite naturally was the chief sufferer from this epidemic of dishonesty.

The cry for relief was heard, the remedy being the Corporate Securities Act, or Blue Sky Law, enacted for the purpose of sifting the illegitimate from the legitimate, the bad from the good.

The crooked promoter and his twin brother, the high pressure salesman, still are with us, (*Continued on page* 338)

The ANNUAL CHECK-UP *on* PROGRESS

By REX MARTIN *

Cooperation, Not Isolation, The Keynote Of Industrial Progress—The Rapid Adaptation Of Mechanization, The Cooperative Spirit Developed By The Annual Cincinnati Meetings, Evidences Of The Progress The Industry Is Making From Its Old Isolation Theory To The Modern Basis Of Cooperation

THIS is not an indictment of the coal industry, despite the fact that I take as the point of my departure a critical attitude towards a condition which will, as I go on, seem to have possibilities for elimination.

"Isolation"—of individuals, of properties, and of ideas—is the unfortunate allotment of those connected with the operating phase of the coal mining industry.

Just how much the industry has suffered from these factors may be measured by the lack of mechanical progress within the industry; this, compared to the mechanical advance of other industries.

Charles Piez on one occasion said: "The industrial supremacy of a nation can be determined by the degree to which it has substituted machine power for man power." Isn't that true of individual industries as well as of nations? Moreover, it is equally true that progress can not be made while either individuals or industries remain in a more or less isolated state. For "isolation" is conducive in the individual, to the thought that his problems are so different from that of his neighbor as to preclude success without especial reference to his own conditions. This thought has held more or less constant in the coal industry.

Twenty-five and 30 years ago, with the advent of the cutting machine, it was thought that "they might work under Jim Jones' conditions, but not under mine"; yet today there are really but three types of cutting machines, and these meet nearly all of the varying conditions of mining.

Acceptance of this fact was, however, a slow and tedious process, requiring consistent effort on the part of the manufacturer—to improve his product to the point where it would meet with the exacting requirements of natural conditions and secure the approval of the operator.

Rex Martin

The acceptance of the cutting machine was, as I say, a slow process, but during this time no intermediate agency existed, as is true today, whereby a wide interest could be worked up by a group of individuals whose only recompense lies in promoting progress within the industry.

How effective this agency has been in the promotion of new machinery can be gathered by a study of an analogous situation which exists today in the matter of mechanical loading.

More progress has been made in this field within the last three to four years than has been made in any comparable field in the history of the industry. Mechanization of mines is the actual turning point of the coal industry, for—by virtue of the revolutionary methods required for its successful adoption—nearly if not all other machinery incident to mining must keep the pace. Therefore one can no longer remain "isolated" and yet obtain a clear and accurate picture of what the new era in mining holds for those who desire progress.

It is a comparatively simple matter to check up on progress—the annual exposition of coal mine equipment to be held in Cincinnati from May 7 to 12 offers such an opportunity.

Here will be displayed all of the latest developments in new machinery. One can go from booth to booth making mental notes of what he has seen, and often hear applica- (*Continued on page* 338)

* Engineer, The Link-Belt Co., Chicago; Member Board of Governors, Managers Division, The American Mining Congress.

A Bridle Path Along The Potomac.

© *Harold Gray.*

LEGISLATIVE REVIEW

Congress Looking Forward To Adjournment—Legislation Being Rapidly Disposed Of—War Mineral Relief Bill Action Nears —Coal Investigation Continues In Committee—Patent Inquiry Suggested—Tax Bill Again Taken Up

AFTER a session of five months which began last December, members of Congress are looking forward to an early close of the present session. The important pieces of legislation which have commanded the attention of the country and of Congress are being rapidly disposed of so as to clear the calendar and permit of a prospective early adjournment of the present session. The Senate has disposed of the Muscle Shoals, farm relief and flood control legislation, and it remains only for that body to act on the tax revision bill in order to clear its calendar for the closing of the session. Action on the tax bill is anticipated some time in May and the Senate leaders are estimating that it will be possible to adjourn by May 19. House leaders are figuring on adjournment by June 8. That body has already passed the tax bill and will require only a short time to dispose of the measure after it is acted on by the Senate through adoption of the conference report which will cover Senate amendments. Business moves more rapidly in the House, where measures can be put through under limited debate, and it is possible that the House can dispose of the important legislative bills, such as Muscle Shoals, farm relief, flood control, and possibly Colorado River development legislation, before June 8. Senate leaders plan early consideration of the Colorado River bill, against which a strong fight will be made by Arizona representatives. It is not expected that failure to pass any of these major legislative proposals will deter Congress from adjourning late in May or early in June if its leaders so dispose, as most of the measures are highly controversial and have been pending in Congress for some time past, so that their postponement until another session will not work injury to the country.

Prospects for early action by the House on a bill already passed by the Senate to permit war mineral claimants to appeal to the Court of Claims appear bright. This measure came up in the House recently when bills were considered under the five-minute rule. Objection to the bill was not directly made, but it was passed over for later consideration without prejudice in order to permit its discussion at a time when it could be debated beyond the five-minute rule. Should objection be made, however, to consideration of the measure at a later time, it is understood that opportunity will be given by House leaders to call up the bill under suspension of the rules, which will require a two-thirds vote to pass the measure. The same opposition which existed against this legislation in former sessions does not appear to now prevail, as the bill does not open up new cases, but simply allows for appeals to the Court of Claims of cases already passed on by the Interior Department, which will protect the government's interests.

Some observers say that the Senate Committee on Interstate Commerce, which has been conducting an investigation into conditions in certain coal fields since March 7, will not conclude its inquiry before adjournment of the present session. This will mean that there can not possibly be any legislation enacted by Congress intended to improve conditions in the industry before the next long session beginning in December, 1929, as the next session is a short one, lasting only three months, beginning in December, 1928, and terminating March 4, 1929. Not much general legislation is enacted at a short session, but if an extra session of the new Congress, which takes office March 4, 1929, is called, it could consider coal legislation. The investigation by the committee has been marked by a sharp controversy over the admissibility of testimony as to cost of production of coal. The committee heard argument for more than a week on this point, the union contending that the investigation should reveal such costs, while the operators insisted that as the mining of coal is not interstate commerce, the committee had no jurisdiction. The committee decided on a middle-ground course, which was agreeable to both sides, involving the statement of cost of production by the year's total instead of detailed cost of production per ton segregated by various items. The committee has practically completed consideration of the Pennsylvania situation, although Governor Fisher, of Pennsylvania, has not indicated his willingness to be examined by the committee, and the committee has not shown a disposition to force his testimony. Recently the investigation has covered the West Virginia field, the principal witness being J. G. Bradley of Dundon, W. Va., president of the Elk River Coal and Lumber Co. Mr. Bradley is also president of the American Mining Congress and formerly was president of the National Coal Association. He is recognized as an outstanding operator and an authority on the coal situation. Mr. Bradley made a spirited defense of the operation of mines by non-union labor, contending that coal from such mines has saved the country from distress created by the numerous strikes called by the union. He also defended wage rates in non-union mines, claiming that they are higher than the average for more than 27 other industries. During the last week of April defense testimony was given by Ohio operators in reply to union charges involving the situation in that state.

Another investigation by Congress is in prospect, Senator King, Democrat, of Utah, proposing an inquiry by a committee of five Senators into patent procedure covering interference cases and the extent to which suppression of the use of patents and the cross licensing of patents contributes to monopoly in industry.

Land legislation before Congress includes a bill, which has been reported by a Senate committee, to grant title to 160-acre tracts of land at $1.25 per acre where the land has been held for more than 20 years under claim or color of title.

Legislation which has been pending some years intended to permit combinations in the United States to meet monopolies in foreign countries over potash and other raw materials was defeated in the House. The opposition claimed that the measure was designed mainly to foster a monopoly in the rubber industry and that potash and the other raw materials were only included in the measure to make it appear more general in character.

The following is a summary of bills recently introduced, and the status of those previously introduced, and on which action has been taken either by committees or by the Senate or House:

War Minerals

H. R. 11411 and S. 1347. These bills permit war mineral claimants to appeal to the Court of Claims. Reported by the House Mines and Mining Committee.

S. 3776. Mr. Nye (Rep., N. Dak.); and H. R. 12243. Mr. Sinnott (Rep., Oreg.)

by request of the Interior Department. These bills authorize patents to 160-acre tracts of land which have been held under claim or color of title for more than 20 years, on payment of not less than $1.25 per acre. Valuable improvements must have been placed on the land. The Government reserves the coal and other minerals in the land, which are to be disposed of under the leasing or mineral land laws. Public Lands. The Senate committee reported the Senate bill.

H. R. 8126. This bill prohibits prospectors or miners from killing game or birds for food purposes in Mount McKinley National Park, Alaska. Passed by Senate.

S. 3949. Mr. Oddie (Rep., Nev.). This bill provides that coal and other minerals shall not be withdrawn from entry in lands which have been or may hereafter be withdrawn for livestock watering purposes. Public Lands.

S. 3777. Mr. Nye (Rep., N. Dak.); and H. R. 12486. Mr. Sinnott (Rep., Oreg.) by request of the Interior Department. These bills propose to repeal the stock-raising homestead land laws. Public Lands.

S. 3775. Mr. Nye (Rep., N. Dak.) by request of the Interior Department. This bill proposes to repeal the desert land laws. Public Lands.

H. R. 11020. This bill validates the following mineral land entries: Of the Pacific Portland Cement Company to the empire mill site in the Carson City, Nev., land district; of the Pioneer Gold Dredging Company to a placer claim in Cleary Creek, Fairbanks, Alaska, land district and of the Columbia Oil Shale and Refining Company, the latter on payment of $1.25 an acre, with a reservation by the Government of the oil, coal and other minerals. Passed by the Senate.

H. R. 8927. This bill proposed to authorize combinations of Americans to meet foreign monopolies in potash and other raw materials. The bill was defeated in the House by a vote of 120 to 181.

Coal Consolidations

H. R. 12105. Mr. England (Rep., W. Va.). This bill proposes to promote consolidation and cooperation in the mining and marketing of bituminous. The bill provides:

"That it shall be lawful for companies, or individuals, or associations of individuals or companies, engaged in the mining or marketing of bituminous coal to act together in associations, corporate or otherwise, with or without capital stock, in mining or in collectively handling and marketing bituminous coal in interstate and foreign commerce. Such trade associations may have mining and marketing agencies in common, and such associations and their members may make the necessary contracts and agreements to effect such purposes.

"Nothing contained in sections 1 to 7, inclusive, or section 15 of chapter 1, of the act of July 2, 1890, as amended October 15, 1914, relating to monopolies and combinations in restraint of trade, shall be construed to forbid the formation of such associations organized solely for the purposes of mining or marketing bituminous coal." Judiciary.

H. R. 339. This bill permits owners of placer mining claims in Alaska to pay into the school and road fund an amount equal to the annual assessment work required to be performed upon the claims instead of performing such improvements on the land. Passed by the House.

H. R. 8831. This bill provides for collection by the Interior Department of a fee of 3 percent from royalties on the production of minerals from leased Indian lands for expenses of supervision of the leases. Passed by the Senate.

S. J. Res. 119. Mr. Shipstead (F. L. Minn.); and H. J. Res. 249. Mr. Carss (Rep., Minn.). These bills authorize the Government to accept title to land in Duluth for a Federal building with a reservation of the iron ore and other minerals in the land by the owner with a right to explore and mine the deposits. Public Buildings.

Experiment Station

S. 4017. Mr. Thomas (Dem., Okla.); and H. R. 12771. Mr. Howard (Dem., Okla.). These bills provide $500,000 for a plant at Bartlesville, Okla., for investigations of the Bureau of Mines. Mines and Mining.

S. Res. 173. Mr. Couzens (Rep., Mich.). This resolution calls for the resignation of Secretary of the Treasury Mellon, based on his alleged connection with oil and coal interests, which have been the subject of investigation in the Senate.

S. 1794. This bill establishes the following land offices: Helena, Miles City, Lewistown, and Glasgow, Mont.; La Grande, Oreg.; Rapid City, S. Dak.; Hailey, Idaho; and Elko, Nev. Reported by Public Lands Committee.

S. 3867. Mr. Pine (Rep., Okla.); and H. R. 12574. Mr. Cartwright (Dem., Okla.). These bills extend until September 25, 1932, existing coal and asphalt leases on lands of the Choctaw and Chickasaw Indians in Oklahoma and for payment by purchasers for these mineral deposits. Indian Affairs.

H. R. 12520. Mr. French (Rep., Idaho). This bill refers to the Court of Claims for settlement claims of the Nez Perce Indians of Idaho for gold mined and removed by white men without authority prior to the treaty with the Indians of June 9, 1863. Indian Affairs.

S. 3365. This bill authorizes mining leases on lands of Indians on the Shoshone or Wind River Reservation in Wyoming. It appropriates $50,000 for surveys of the lands. Passed by the Senate and reported by House Indian Committee.

S. 3593 and H. R. 11580. These bills authorize the sale or lease of lands of the Fort Peck Indians in Montana. Reported by Indian Committees.

H. R. 10885. This bill amends the leasing act affecting sodium prospecting permits and leases. It permits a lease to all the land under a prospecting permit on discovery of sodium instead of to one-half of the area under the present law. The minimum royalty is reduced from 12½ to 2 percent and the rentals from 50 cents to 25 cents per acre for the first year and from $1 to 50 cents per acre for the second to fifth years. Passed by the House. A similar bill, S. 3375, has been reported by the Senate Public Lands Committee.

Blue Sky

S. 3901. Mr. Capper (Rep., Kans.); and H. R. 12731. Mr. Denison (Rep., Ill.). These bills propose to regulate the issuance of securities, including those in an oil, gas or mining lease, in the District of Columbia. District of Columbia.

H. R. 12451. Mr. Bell (Dem., Ga.). This bill provides $5,000 for a rented assay office at Dahlonega, Ga. Coinage.

H. R. 5773 and S. 728. These bills provide for power development on the Colorado River. They appropriate $125,000,000. Reported by Irrigation Committees.

S. 3876. Mr. King (Dem., Utah). This bill provides for an investigation by a commission appointed by the President as to the best plan to develop the Colorado River Basin. It appropriates $100,000.

S. J. Res. 46. This resolution provides for operation by a Government corporation with $10,000,000 capital stock of the nitrate and power project at Muscle Shoals, Ala. Reported by House Military Committee.

H. R. 12448. Mr. Morin (Rep., Pa.). This is similar to the foregoing. Military Affairs.

S. 3770. Mr. Ashurst (Dem., Ariz.); and H. R. 12411. Mr. Douglas (Dem., Ariz.). These bills authorize the Federal Power Commission to issue permits and licenses on Salt River in the Fort Apache and White Mountain or San Carlos Indian Reservations in Arizona for hydroelectric power development. Indian Affairs.

H. R. 12170. Mr. Taylor (Rep., Tenn.). This bill changes to Coal Creek the name of the Cove Creek site for a power dam on the Clinch River near the city of Coal Creek, Tenn. Military Affairs.

IMPORTANT BILLS REVIEWED IN THIS ISSUE

Mining

S. 1347—Reported by House Committee. War Minerals.
S. 3776—Reported by Senate Committee. Land Title.
H. R. 8927—Defeated by House. Raw Materials.
H. R. 12105—England (R., W. Va.). Bituminous Consolidations.
S. 4017—Thomas (D., Okla.). Experiment Station.
S. 3867—Pine (R., Okla.). Coal Leases.
H. R. 10885—Passed by House. Sodium Leases.
S. 3901—Capper (R., Kans.). Blue Sky.
H. R. 12451—Bell (D., Ga.). Assay Office.

Power

H. R. 5773—Reported by Committee. Colorado River.
S. J. Res. 46—Reported by House Committee. Muscle Shoals.
S. 3920—Tyson (D., Tenn.). Electric Regulation.

Industrial

S. Res. 188—King (D., Utah). Patent Inquiry.
S. 3922—Glass (D., Va.). Freight Rates.

ELECTRIC CONTROL

S. 3920. Mr. Tyson (Dem., Tenn.). This bill provides for the regulation through state agencies of the transportation and disposition of electric energy in interstate and foreign commerce. Interstate Commerce.

S. 1710. This bill establishes in the Bureau of Standards a hydraulic laboratory to study the control of waters and hydraulic structures and instruments. It appropriates $350,000. Passed by Senate.

S. 3733. Mr. Dill (Dem., Wash.). This bill authorizes the Department of Agriculture to furnish at cost explosives to settlers for clearing and reclaiming stump and timber land areas. It appropriates $25,000. Agriculture.

H. J. Res. 126. This resolution authorizes Government departments to make exhibits at the Pacific Southwest Exposition at Long Beach, Calif., this year. Passed by the House.

S. 3966. Mr. Copeland (Dem., N. Y.). This bill would prohibit the use of spray-painting, compressed-air machines in the territories and possessions of the United States and the District of Columbia and in performing public contracts. Labor.

H. R. 12688. Mr. James (Rep., Mich.). This bill authorizes the construction of oil and gasoline storage facilities at various army stations. Reported by Military Affairs.

H. J. Res. 264. Mr. Wainwright (Rep., N. Y.). This resolution would authorize the mobilization of all the resources of the country during war. Rules.

S. 726. This bill would require district courts to decide cases within five months after their submission. Passed by Senate.

S. J. Res. 113. This resolution extends until 1929 the present basis upon which immigration quota restrictions are based. Enacted into law.

H. R. 12205. Mr. Berger (Soc., Wis.). This bill would establish a bureau of unemployment insurance in the Department of Labor and a system of compulsory insurance of wage earners against unemployment. Judiciary.

H. Con. Res. 27. Mr. Graham (Rep., Pa.). This resolution provides for an investigation by a committee of three members each of the Senate and House Judiciary Committees as to employment for Federal prisoners. The commission would report in December as to the cost of buildings and equipment for the manufacture of goods by Federal prisoners. The resolution appropriates $5,000. Rules.

PATENT INQUIRY

S. Res. 188. Mr. King (Dem., Utah). This resolution provides for an exhaustive investigation of patent procedure by a committee of five Senators, reporting at the first session of the 71st Congress in 1929. The committee is to investigate and appraise the present practice and procedure of the Patent Office, to discover evils which may exist in relation thereto, particularly with respect to the practice and procedure in interference cases; to study ways and means for revising and improving Patent Office procedure; to investigate the extent to which suppression of the use of patents and the cross licensing of patents contributes to monopoly or to the monopolistic control of industry; and to recommend legislation necessary to correct abuses and to insure the maximum protection to inventors, scientists, and the industries of the country.

The basis for the investigation is set forth in the following preamble:

There are awaiting action in the Patent Office more than 95,000 applications for patents, many of which have been pending without action for from six to eight months; it usually requires from two to seven years after application for a patent to issue from the Patent Office, during which time the applicant is powerless to protect his invention against infringers, with the result that inventions which might be effective in promoting new industries often, because of the delay in the Patent Office, lose their effectiveness and value; the procedure of the Patent Office to determine priority of invention as between applicants claiming the same invention is unsatisfactory and expensive, and attempts to adjudicate valuable rights between parties without the procedure and facilities of equity courts which permits such Patent Office practice to be abused by unscrupulous parties to exhaust the resources of bona fide inventors and to delay and prevent the issue of patents to applicants who are justly entitled thereto; the practice of the Patent Office in interference cases operates in many instances to cause forfeiture and abandonment of valid applications for patentable inventions; it is claimed that the present practice of the Patent Office tends to give undue advantage to unscrupulous persons who intervene dishonestly in order to prevent the issue of patents to competing inventions and who otherwise throw applications into interference in order to extort and exact money as an inducement to waive adverse claims; it is claimed that patents of great advantage to the industry and economy of the country have been and are being bought up by trusts and monopolies in order to prevent the use of such inventions by competitors, which practice results in the suppression of such inventions as far as service to the industries of the country is concerned; it is claimed that patented inventions affecting certain industries are by a system of exclusive cross-licensing made the instruments of monopolistic domination of such industries. Patents.

H. R. 6687. This bill expands the jurisdiction of the Court of Customs Appeals to hear patent appeals. Passed by the House and reported by the Senate Judiciary Committee.

H. R. 12695. Mr. Vestal (Rep., Ind.). This bill authorizes the licensing of patents owned by the United States. Reported by Patents Committee.

H. R. 12620. Mr. Parker (Rep., N. Y.). This bill authorizes consolidations of railroads. Reported by Interstate Commerce Committee.

S. 3945. Mr. Brookhart (Rep., Iowa). This bill provides for a merger of railroads into a system extending from the Atlantic to the Pacific. Interstate Commerce Committee.

S. 3980. Mr. Dill (Dem., Wash.). This bill forbids (*Continued on page* 338)

REVIEW *of the* MECHANIZATION SURVEY

By G. B. SOUTHWARD

Mechanized Mining Successfully Operating In All Coal Fields—Practicability Proven By Development And Progress During Severest Competitive Period In History Of Coal Mining—Production Figures Show Marked Gains During Year

THE reports on the mechanization survey which have been published during the past year have described 38 mechanized mining operations. The survey has included underground inspections in more than 60 coal mining operations, but the scheduled rate of publication has only permitted 38 of these to be described so far. These 38 have been selected as illustrating typical practices and developments in those mines where mechanization is on a practicable operating basis, and the reports have covered the actual coal loading at the face by the three more or less standard types of equipment—mechanical loaders, scrapers, and conveyors—and may be summarized as follows:

Ten operations with mechanical loaders in room and pillar mining.

Four mechanical loader operations in entry development.

Two mechanical loader operations on long-face mining.

Three mechanical loader operations in rock work.

Four conveyor operations in room and pillar mining.

Five conveyor operations on long-face mining.

One conveyor operation in anthracite coal—room and pillar.

Six scraper operations on long-face mining.

Two scraper operations in anthracite coal—room and pillar.

One scraper operation in anthracite coal—long-face mining.

These operations show a wide diversity in methods of mining, heights of coal, and seam conditions as worked by the three different types of equipment in both anthracite and bituminous coal, and it is believed that these show a representative cross-section of the mechanization development as it now exists. It is further believed that these reports are sufficiently comprehensive in their scope to give an accurate picture of the entire development in the United States, since they include operations in the following nine states: Pennsylvania, Ohio, Indiana, Illinois, West Virginia, Virginia, Alabama, Wyoming, and New Mexico.

This series of reports has completed the first phase of the mechanization survey, which was intended to describe only the actual coal-loading operation at the face in order to show the manner in which the three types of equipment were being applied and to determine whether or not the actual loading operation was proving a practical success. It is hoped that these reports have served this purpose and have succeeded in giving to the coal-mining industry a convincing presentation.

The second phase of the survey is expected to start immediately, and the scope of this is to be extended so as to include entire mining operations which have been completely mechanized and to show how the general inside and outside operations are being coordinated into one operating unit with mechanized loading as one integral part. There are a number of mines which have now developed to this point and the various steps in their progress from their first experimental operation to their present methods should be of interest and value to the industry.

It is also suggested that a rather detailed study be given to the question of roof action in long face mining. Quite a number of operations with roof caving are now being carried on, varying from short faces on open end pillar recovery to long faces 300 or more in length with many different types and methods of roof support, such as timbers, cribs, steel jacks and pack walls.

The roof action which occurs in these operations is quite diversified and is difficult to correlate. In spite of the apparent contradictions which seem to exist, we know that all roof action is governed by natural laws, and the distance of the roof overhang, the type of roof supports, and the manner in which the roof breaks must conform to these laws before a successful action will result. However, we have not yet reached the point where we can formulate general rules or practices, and before we can do this additional data must be collected and studied.

Before starting on this phase, however, it is well to review the extent to which mechanized mining has now developed, and a table showing the tonnage produced in the year 1926 as prepared by Messrs. F. G. Tryon and L. Mann, of the United States Bureau of Mines is submitted herewith. These figures show that during the year 1926 in all of our mines more than 10,000,000 tons of bituminous coal were loaded by mechanical loaders and scrapers. This amounted to slightly less than two percent of the total coal production. The tabulation also shows that there were 164 mines using mechanized loading equipment, and this number was also about 2 percent of the total number of operating mines. The production by conveyors is not included, and if added would, of course, increase both these percentages to some extent.

In connection with a study of these statistics some other figures taken from the 1926 Bureau of Mines statistical report should be taken into consideration. These figures, covering all types of mining, show that the total bituminous production during the year was 573,366,985 tons and that this was produced by a total number of 7,177 mines operating for an average of 215 days. However, the big majority of these 7,177 mines were small producers, and there were but 1,668 mines of medium or large capacity that produced an annual tonnage of 100,000 or more tons. The production from these larger mines amounted to 79.1 percent of the total output of the country. Since these 1,668 mines working only two-thirds of the time produced about four-fifths of the entire production of the country, it seems reasonable and safe to assume that our present total bituminous coal requirement of between 500,000,000 and 600,000,000 tons per year could be produced by about 1,600 mines, now equipped, manned and operating, if these were working on a full-time basis.

When we, therefore, attempt to figure on the present and possible future extent of mechanized coal mining, our field of inquiry does not necessarily include the entire scope of 7,000 or more operating mines, as it can very properly be narrowed to the 1,600 mines which have a potential capacity equal to our total coal requirement. On a strict mathematical basis, the possibility of mechanizing 1,600 mines is about four and one-half times as great as the possibility of mechanizing 7,000, and when we consider that these 1,600 mines include the larger and more progressive coal companies, the possibility of mining a large proportion

MECHANICAL LOADING UNDERGROUND IN BITUMINOUS COAL MINES IN THE UNITED STATES, IN 1926

Compiled by F. G. TRYON AND L. MANN, *Coal Division, Bureau of Mines, Department of Commerce.*

(The table covers all devices by which most of coal handled is loaded without hand shoveling, including loading machines, combined cutting and loading machines, scraper loaders, shaking trough conveyors equipped with shovel attachment on front end (so-called "duckbill"), and certain long-face conveyors designed to receive coal as shot down. It does not cover conveyors and mine-car loaders on which all the coal has to be shoveled by hand, although it should be remembered that such devices, by reducing the height to which the miner must lift the coal, greatly reduce the labor of hand shoveling. Complete statistics on the use of such hand-loaded conveyors were not collected for 1926, but the information available indicates that the quantity handled by them runs over a million tons.)

STATE	Mines that reported loading by machine in 1926: Number of mines	Number of loading machines	Net tons loaded by machine	Total production of these mines: Net tons including hand loading	Total production of these mines: Percent loaded by machine	Percent of state output loaded by machines	Other mines reporting loading machines but not tonnage *: Mines	Other mines reporting loading machines but not tonnage *: Machines
Alabama	3	30	111,803	458,455	24.4	0.5	1	†
Colorado	3	†	†	†	†	†	2	†
Illinois	18	107	2,035,521	8,050,665	25.3	2.9	1	†
Indiana	13	87	2,166,737	2,423,681	89.4	9.3	..	..
Iowa	6	8	84,325	949,732	8.9	1.8	1	†
Kentucky	10	20	181,763	4,288,921	4.2	.3	5	5
Maryland	1	†	†	†	†	†	..	..
Michigan	2	†	†	†	†	†	..	..
New Mexico	1	†	†	†	†	†	..	..
North Dakota	1	†	†	†	†	†	..	..
Ohio	3	10	122,576	1,303,590	9.4	.4	2	†
Pennsylvania	20	48	855,578	5,512,447	15.5	.6	4	5
Tennessee	2	†	†	†	†	†	2	†
Utah	6	8	114,619	1,214,530	9.4	2.6	1	†
Virginia	6	17	1,086,480	3,391,417	32.0	7.7	2	†
West Virginia	29	57	2,000,636	9,354,888	21.4	1.4	12	18
Wyoming	7	44	1,142,304	1,796,396	63.6	17.6	..	..
Undistributed	...	19	119,853	1,584,411	7.6	.5	..	15
Total	131	455	10,022,195	40,329,133	24.9	1.8	33	43
Recapitulation:								
Scraper loaders	50	133	1,554,372			0.3	13	16
Shaking - shovel and "self-loading" conveyors ‡	10	27	681,463	40,329,133	24.9	0.1	..	..
Other loaders §	71	295	7,786,360			1.4	20	27
Total	131	455	10,022,195	40,329,133	24.9	1.8	33	43

* In practically all of these, the use of loading machines was in the experimental stage only. † Included in "Undistributed" to avoid disclosing individual operations. ‡ Includes shaking trough conveyors equipped with so-called "duckbills," on which reports indicated 60 to 90 percent loaded without hand shoveling, and also two makes of long-face conveyors designed to receive coal as shot down, on which a large part of the coal (sometimes more than half) is loaded without hand shoveling. These types can not be shown separately without disclosing individual operations. § Includes mobile digging and loading machines and cutting and loading machines.

of our tonnage mechanically does not seem quite so remote. When we consider further that 164 mines reported the use of mechanical equipment in the year 1926, we see that the real significant fact is—not that 2 percent of all our mines—but that 10 percent of our larger producing bituminous mines in 1926 were actually operating or experimenting with mechanization equipment.

This fact assumes greater significance when we see the extent to which mechanized mining has spread. Thirty-one states are reported as mining coal, and 17 of these are mining some coal with mechanized loading, but as these 17 states produce nearly 97 percent of our entire bituminous coal production, it is no exaggeration to say that the published statistics show mechanized mining in every one of our principal coal-producing states. From our mechanization reports we can go further and say that some form of mechanized mining is now being used under practically all usual mining conditions and in all mining systems, and from the statements of coal operators who are mining mechanically it seems evident that mechanization is not only competing successfully with hand mining under average favorable conditions, but is also able to operate successfully where mining conditions are so severe as to prohibit hand methods.

It must be remembered that the figures above quoted are for the year 1926, and it is undoubtedly true that there has been a very material increase in mechanized mining since these were compiled. While complete figures are not yet available, it is estimated from various sources that on April 30, 1928, the mines in the United States which were operating mechanical loaders, scrapers and conveyers were producing at the rate of from fifteen to eighteen million tons per year by mechanized loading.

We cannot yet say, or even predict, the extent to which mechanical mining will be adopted by our bituminous coal industry. However, the successes which have now been achieved are doubly impressive when we consider that this progress has been made within the last five years, and that during one of the most severely competitive periods in the history of bituminous coal mining — when only the fittest have been able to survive—mechanized mining has not only survived but has developed and progressed.

COAL

NEWELL G. ALFORD
Editor

Practical Operating Problems of the Coal Mining Industry

MECHANICAL LOADING *with* SHAKING CONVEYORS *in* SOUTHERN WYOMING

By O. G. SHARRER *

Universal Shaker Loader completely assembled.

Close Timbering Requires Conveyors —Method Of Operation Detailed— Two Systems Developed—Costs Show A Decided Saving—Sixty-Three Feet Of Entry Driven Per Twenty-Four Hours—Labor Attitude Gratifying

NEARLY everyone who has had any connection with coal mining in the last 10 years is fairly familiar with the various attempts made to find some device or machine that would eliminate hand labor in the operation of placing coal into mine cars. It is, therefore, unnecessary to go into any detail justifying a mechanical loading program.

Previous to 1925, the Union Pacific Coal Co. had loaded a considerable tonnage with various types of loaders, and had also done a large amount of research work as to the practicability of various types of machines. The results of this preliminary experimental work showed that approximately one-half of their total coal reserve could be mined mechanically with machines and methods then available.

No machine then available could show any economy under conditions as found in the remaining properties and it was at once apparent that these mines would have to be worked by hand or some radically different machine obtained. The new machine would have to meet some very severe conditions, as the roof in the majority of cases is a friable shale, necessitating that every opening be cross-barred and lagged with very heavy timber. Pitches vary from 5 to 17 degrees, with bands of impurities varying from 1 to 10 in. in thickness. While these dirt bands are not continuous, no mine is ever entirely free from them, and they are of such nature as to make the cleaning of this coal very difficult.

In going over the various kinds of machines then offered, it became apparent that some form of conveyor was the only device that would have any chance in the closely confined space necessitated by heavy timbering. The Eickhoff Shaking Conveyor was finally selected, principally on account of its simplicity and low cost, no one dreaming at the time how wise the selection would prove to be.

The first Eickhoff conveyor was looked upon as a transportation unit only, and it was hoped that by concentrating a group of men in a small area, the mining operation could be speeded up with a corresponding saving in timber and maintenance.

The first work was done on various shapes and sizes of long faces, and while this work was not a complete failure, it showed very little profit and the principal benefit derived was the proof of the fact that long-face work can not be successfully adapted to all mining conditions. The mining operation in itself was successful, showing a very reasonable cost, but when timber costs and labor of holding faces open were carefully figured, the operation showed very little real profit.

At this time a shaking conveyor was being used in the Union Pacific Coal Company mines at Rock Springs, Wyo. Superintendent F. L. McCarty conceived the idea of placing some kind of an automatic shovel on the end of this conveyor, and after some experimenting perfected the "McCarty Duck-bill." This device was successful from the start and the machine loaded coal from narrow entries at a very low cost. It was then decided to adapt the McCarty Duck-bill to the mining conditions in Superior, and after driving a small amount of development, the duck-bill was started on a modified

* General Underground Foreman, The Union Pacific Coal Co.

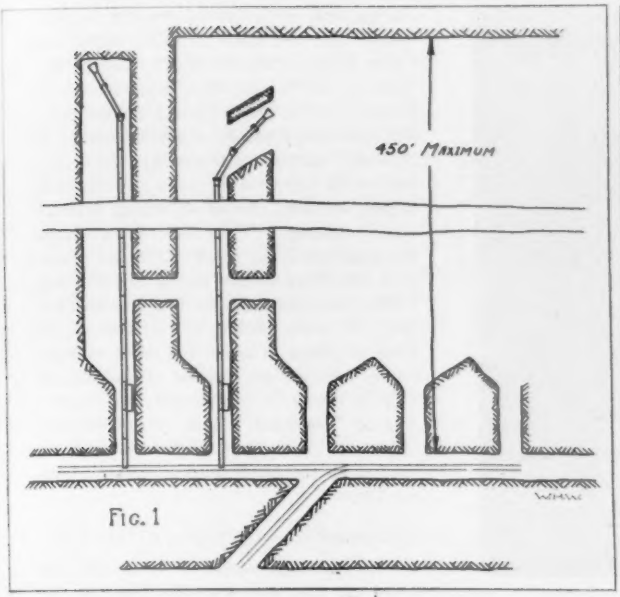


Fig. 1

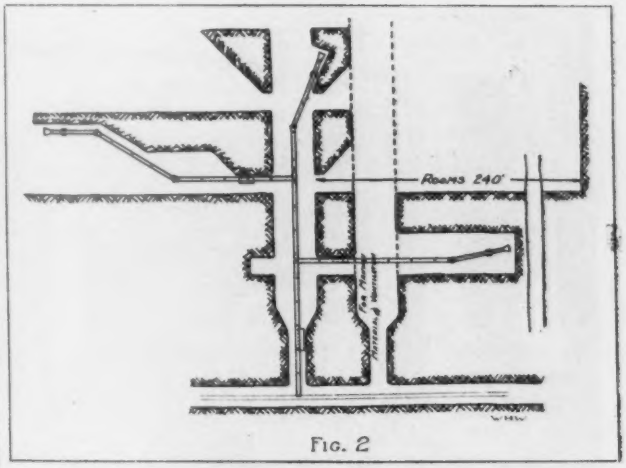


Fig. 2

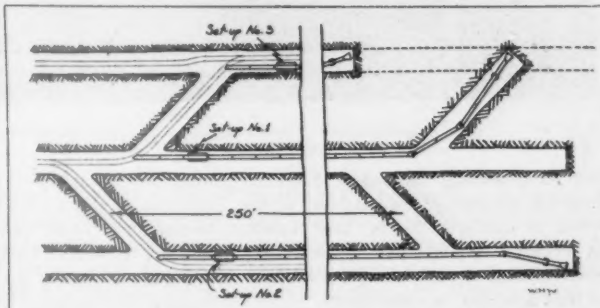


Fig. 3

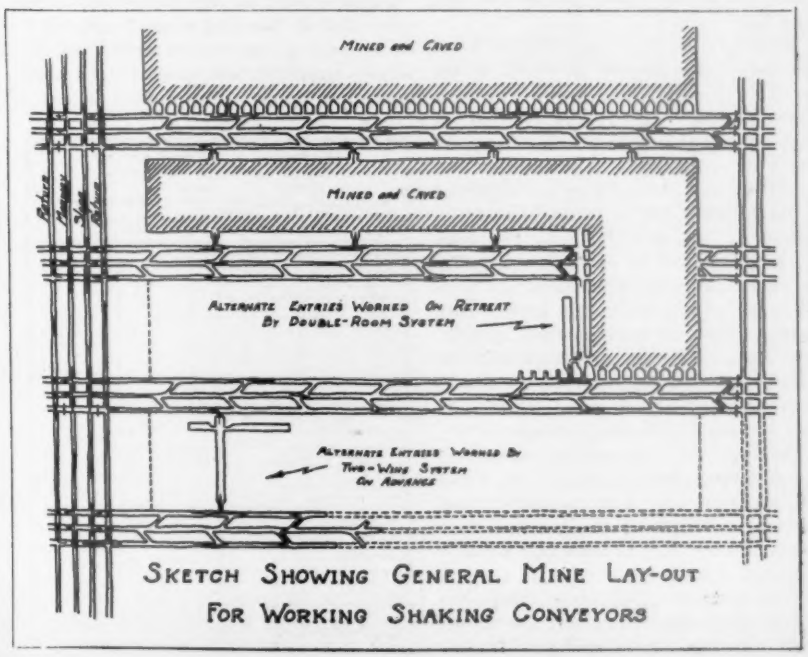
room and pillar system which proved very successful from the start.

Figure 1 shows the first method of applying the duck-bill to room and pillar mining.

Two 25-h.p. shaking conveyors with duck-bills, two mining machines, two Jeffrey coal drills, and two blower fans are used. The crew consists of two machine men who cut, drill, and blast all the coal; two timbermen who prepare and place all timber; one duck-bill runner and two duck-bill helpers, making a total of seven men. While the loading crew cleans up one place, the cutting-machine crew undercuts and blasts the other. The timber crew works in either place, as conditions require. All members of the crew assist in handling material to the face and with all work not directly connected with loading.

The rooms are turned on 45-ft. centers and are driven 22 ft. wide, leaving a 23-ft. pillar. Cross-bars 10 in. in diameter are set at 4-ft intervals, same being lagged with 6-in. lagging set fairly close. Each cross-bar requires five posts or legs for its support. These props must be changed to allow the duck-bill to move from side to side, and this changing operation takes a large part of the timberman's time. When a room has reached its full distance, the pillar is removed at once. A 40-ft. cut is made from the face out and loaded with the duck-bill. Three machine cuts are required to complete this 40-ft. section, all being loaded with the duck-bill. When the first block is taken off the pillar, the conveyor is shortened and all timber in the mined-out area is drawn, allowing the roof to cave. This timber drawing is done on the midnight shift by a special crew employed for this purpose.

An 8-ft. back stump is now left against this caved ground and another 40-ft cut-through is taken out. When this cut-through is completed, the back stump is taken out by hand and shoveled into the conveyor, after which the timber is drawn and the open area caved. It has been learned that a new cut-through must not be started until all standing ground above is caved, for unless this is done riding weight appears and the remainder of the pillar is very difficult to extract. As only one place is on pillar work at any time, the entire crew of seven men can be used to hasten this pillar out, thus assuring a complete recovery. The average time consumed in driving a room up 400 ft. and recovering the pillar is six weeks, as against over two years


Mined and Caved
Mined and Caved
Alternate Entries Worked On Retreat By Double-Room System
Alternate Entries Worked By Two-Wing System On Advance
Sketch Showing General Mine Lay-out For Working Shaking Conveyors

Universal Shaker Loader loading coal in 12-ft. entry.

under hand-loading methods. Approximately 30 percent of the timber is recovered in condition to be used again. This original system has proven very successful and is still being used where it is best adapted to conditions.

Some time after this system was put in operation, two 15-h.p. drives were purchased and the method which is shown in Figure 2 was started. In this method two places are driven up the pitch with 25-hp. drives; one drive is then removed and the room used as a man and material road, also as an airway. The other drive remains in place and is used as a transportation unit to handle coal from two 15-hp. units. These 15-hp. machines drive side rooms in a distance of 240 ft. and draw the pillar back.

The crew organization is the same as that used in Figure 1; timbering and pillar drawing being also the same.

This system is particularly adaptable where it is not desired to cut the entry stumps too frequently, as it necessitates openings at 480-ft. intervals instead of 45-ft., as under the original system. It also allows the 25-hp. unit to remain in one location for eight months, instead of six weeks, which reduces moving and installation charges. Some difficulty is encountered from weight tending to ride down the main conveyor way, but this has not been serious in any case.

These two systems are now being used, both showing excellent results in operation. System No. 1 is best adapted to entries working on full retreat, and system No. 2 works best where entries are being worked advance, as main entry supporting pillars can be made much more substantial.

Tonnages and costs are practically the same for both systems. The average tonnage per man shift on either system is 15 tons to date. Costs show a decided saving over hand mining after interest and depreciation charges are considered.

Figure 3 shows the method of entry driving now in use. Two machines were used on this system when it was first tried out, but it was soon learned that one machine working double shift could easily drive entry fast enough to fulfill our requirements.

Figure 3 shows a general line up for driving three entries with one shaking conveyor. The middle entry, which is the main haulage road, is always driven first; slants are driven to the top and lower entries by means of swivels and duck-bill.

When set up No. 1 (see Figure 3) is completed, the machine is moved to set up No. 2, cars being served through slant by motor or Treadwell hoist in trips of eight cars each. While set up No. 2 is being driven, track, bonding, switches, and trolley wire are extended in the middle entry in preparation for a new cycle. Set up No. 2 being complete, the unit is moved to set up No. 3 in the top entry, which is completed before moving to set up No. 1 of a new cycle. This method allows all work on track, permanent timbering, etc., to be done without interfering with the conveyor operation, and gives sufficiently rapid advance to care for any reasonable tonnage.

The crew on this system consists of one cutting-machine operator, one duck-bill operator, one duck-bill helper, and one loading head man, a total of four men. The average advance per shift in 8-ft. coal is 15 ft.

This method of driving entry has proven very satisfactory and has shown great saving over hand methods. In case exceptional progress is desired, a conveyor may be used in each entry and three shifts worked. By the use of this method, with careful supervision, a progress of 63 ft. in each 24-hour period for each entry has been attained in Rock Springs mines. Permanent track and trolley is installed in both the top and middle entries, also in all slants between these entries. This has been found necessary in order to efficiently serve several machines when rooms are started.

The foregoing applies to strike entries; panel or plane entries are driven up the pitch in pairs in much the same manner except that a hoist capable of hoisting an eight-car trip is used instead of locomotive or Treadwell hoist. Progress and costs are somewhat better in driving entries up the pitch than in driving level entries.

Supervision, Technical Staff, Etc.

Coal mining becomes more complicated in the direct proportion to the number of machines of various kinds used. This law becomes very apparent in the introduction of mechanical loading, for organization and equipment that was successful under hand mining methods may prove totally inadequate when mechanical loading is installed.

This is true both underground and on the surface. The superintendent must be a man with open mind and sound practical mining knowledge. His outstanding qualification is necessarily that of organization for he must be able to attract to him, men of technical ability to head the various departments into which the work must be divided.

The master mechanic and chief electrician are the two key men on the surface and must be experts in their line. The day of the master mechanic whose tools were a hammer and chisel and the mine electrician who could hang trolley wire and repair pump motors is ended

MECHANICAL · LOADER · REPORT

Mine..... District..... Date.....

Location..... Loader No.....

Detailed daily report of Mine Labor and Material for each individual mechanical loading unit.

Labor					Material			
No. of Men	Occupation	Hours worked	Rate per Hour	Amount	Quantity	Articles of Material	Unit Cost	Amount

when a mine is mechanized. The master mechanic must be capable of running a completely equipped shop, must know metals, special gear design, electric welding, etc., and be also able to handle a large force of mechanics. The chief electrician must know his work very thoroughly, for at this time, the application of electricity to coal mining is probably the most complicated of any electrical application now in use. In addition to the foregoing, both of these men must possess the ability to work in harmony with each other for their work and authority overlap to such extent that if either is inclined to be jealous of his rights, they are soon in conflict.

The shop equipment must be up to date and complete. This equipment and personnel is of course predicated on a fairly large output and more than one mine in each division. Smaller companies, however, must at least have the service of a good contract shop or install similar equipment if they wish to insure success.

Along engineering lines a much different policy is necessary than under old hand-loading methods. Progress is exceedingly rapid and this necessitates very careful engineering plans if confusion is not to arise. Development must be planned so that haulage and output will by synchronized. Output and progress must be very closely watched, for if a mechanical mine runs out of development, it means disaster. When a hand loading mine runs out of working places, some men are laid off and the mine continues at a reduced output with no great rise in cost. In a mechanical mine, however, while a machine may be "laid off," its depreciation and interest charges continue and unless all machines are kept in operation all the time, profitable mining soon ceases.

Master Mechanics Daily
MECHANICAL · LOADER · REPORT
Mine..... District..... Date.....
Location..... Loader No.....
Detailed daily report From Mechanical Department of Labor and Material for each individual Loading Unit.

LABOR

No. of Men	Occupation	Hours worked	Rate per Hour	Amount
	TOTAL			

MATERIAL

Quantity	Articles of Material	Unit cost	Amount
	TOTAL		

REMARKS:

Master Mechanic.....
Note - State under remarks nature of work done, or of repairs made. Separate report for each individual Loader upon which work was done.

Side conveyor ready to load coal on main conveyor equipped with Universal Loader. Note heavy timbering.

In the direct supervision of mechanical loading, it has been found necessary to adopt engineering methods that have been in use for some years in many factories, notably in the automobile industry. The three most vital things in this new engineering management, as applied particularly to mining, are: The unit cost record; the time study, and the training of each man to his particular job.

Unit cost records are absolutely essential for each shift of operation if costs are to be kept in line. A standard form of report (see specimen) is filled out for each shift on each machine. This report shows both labor and material expended underground, also a report on conditions encountered during each shift. In addition to this, the master mechanic makes a report on a standard form of all repairs, etc., for each machine for each shift. From a summary of these shift reports, a monthly report of each machine is compiled, also a cumulative period record which is carried throughout the year.

The time study aroused more hostility than any other innovation established, for the miner has never accepted any suggestions or advice as to his methods of working. Everyone from the management to the shoveler looked upon the engineer with his stop watch and note book as a sort of well-dressed spy and treated him accordingly, however, as soon as it was found out that the time study worked to make the job easier and that the engineer was not "carrying tales," everyone became reconciled and the time study is now welcomed by everyone. Time study methods as applied to factories are not applicable to coal mining on account of the great variations in working conditions and the number of uncontrollable factors that tend to hinder production. Much progress has been made, however, in making the basic principles apply so as to give a record of facts in a way that permits the correction of poor practice. Two methods of time study have been worked or rather adapted to our conditions.

First the "man-minute basis" which studies each individual in the crew by minutes during the entire shift. This is a direct study of individual efficiency and helps to determine each man's fitness for his position.

The second method is the "machine-minute basis" which disregards the individual and studies the operation of the machine by minutes during the entire shift. This study shows the efficiency of each machine, also the value of various methods and systems and helps to determine the fitness of various machines for their requirements.

Neither of these time studies is of much value without the other and it is only by a complete analysis of both that corrective measures may be determined. These studies become more valuable in proportion to the number taken as the average time for each operation can be more accurately determined if a large number of studies is used. In this manner theoretically perfect cycles of operation can be set up and various weak links in the series of operations can be located.

Underground, the supervision of machines is under the direction of the mine foreman who has charge of all underground work. To assist him, he has

one or more assistant foremen and in addition to the assistant foreman, a unit foreman for each group of loaders. The number of unit foremen depends on conditions and the distance between various machines, but the unit foreman should never be given more units than he can visit at least every two hours.

The unit foreman is one of the key men underground, for the operation of the various machines depends very much upon his ability. This position was very difficult to fill in the early part of machine loading, for there were then no men with the necessary qualifications for this position. This man must combine a sound knowledge of mining with a general idea of machinery, in addition to this he must be able to direct his crews in such a manner as to get results without any "bull-dozing" or abuse.

The maintenance and repair of all machinery underground is under the direct charge of the machine boss who reports to the mine foreman. The machine boss has a crew of mechanics and electricians under him, the size of the repair crew depending on the number of machines in his charge. All instructions as to methods of repair come from the master mechanic and chief electrician, but the general supervision is vested in the mine foreman.

In addition to the foregoing, each mine foreman is furnished a time-keeper who keeps the time, makes out the various reports required, and in general, relieves the foreman of all clerical work. This has proven to be a forward step for it has relieved the foreman of all petty details and permits him to spend his time in the working places or going over his program for new work.

All these underground officials meet once each week with the mine superintendent for a general discussion of their various problems. These weekly meetings have proven very successful in bringing out suggestions for improvements along all lines and help to keep each man in touch with what his associates are doing. At these weekly meetings the week's cost record is carefully gone over so that each mine foreman is kept in close touch with his progress.

The foregoing plan of supervision has grown from actual working experience, and while not by any means perfect, it has shown itself to be fundamentally sound.

Attitude of Labor

In nearly every instance where mechanical loading has been started, it has encountered the opposition of organized labor, but this has not been the case in southern Wyoming. Wyoming has always been exceptionally free from labor strife of any kind, and no strikes have ever arisen over any differences between the operators and miners. This state of affairs is due to the general commonsense attitude of labor and the very able leadership of the various union officers.

Miners have always feared the competition of any labor-saving device, and with good reason, for if some type of machine proves successful, it usually means that some miners lose their employment. This is the main cause for the miners' attitude toward machines, and one must admit that in many instances their fears have been well grounded.

Before installing any mechanical loaders, the management of the Union Pacific Coal Company laid down as a first rule that no employe was to lose his opportunity to earn a living through the installation of such machinery. This rule looks impossible at first glance, but it has proven to be quite easily carried out in practice.

Mine labor is depleted every year through several channels, as, for instance, every spring certain persons are afflicted with wanderlust and move to green fields; some few collect their savings and retire to other activities; a certain number are eliminated every year by old age and death. It has always been the custom to offset these depletions by a continual hiring of new men, so that in as short a period as five years practically the entire population of a mining village would change. Upon starting to install mechanical loaders, the Union Pacific Coal Company ceased to hire any new men, and only enough machines are being purchased each year to offset the natural depletion of the labor force. This plan has allowed the machines to enter the scene gradually and according to a thorough plan. No man has lost his employment, while the average annual earnings per employe have been very much increased. As soon as the miners became aware of these facts they were reconciled to mechanical loaders and have gone in whole-heartedly to make them a success.

The foregoing has unquestionably been the most important contributing factor to the success of mechanical loading in southern Wyoming and is well worth the careful scrutiny of anyone who contemplates installing any kind of machines.

Driving Gears, Duck-Bills, Etc.

At the present time two makes of shaker engines are being used. The Eickhoff electric drive was purchased first, and then later several Mavor & Coulson electric drives. Both of these engines were designed to drive a conveyor as a means of transportation only and give excellent service when used for this purpose. The duck-bill, however, puts a very severe load on the driving gear, and both these gears must be completely rebuilt before they will stand up while operating a duck-bill. There are several reputable American machinery companies who are now building conveyor drives, and it will shortly be possible to obtain an American-built engine which has been designed especially for the duck-bill service.

Two makes of duck-bill are in use. The original McCarty device which was the first successful application of this principle to shaking conveyor, and the Ernsbarger Universal Shaker Loader. The Ernsbarger device is the result of several years' experience and is a very simple and sturdy machine. There are now 13 McCarty and 24 Ernsbarger duck-bills in use at the various Union Pacific Coal Company mines. Both of these machines are manufactured by the Rock Springs Loader Company, of Rock Springs, Wyo.

Conclusion

The experience of this company over a period of three years, during which time 37 shaking conveyors have been put into service and 527,667 tons of coal have been loaded, may be summed up briefly as follows:

Shaking conveyors are of very little use without some form of automatic shoveling device to eliminate hand shoveling.

Conveyors can be adapted to any height or to any pitch condition. They can be worked under roof conditions which proved impractical by hand mining methods. Coal may be cleaned while being loaded by duck-bill and conveyor better than under hand methods.

The same machine can be used to drive entry or work in rooms, pillars, or long faces.

Union labor can be reconciled to their introduction if the management takes the proper attitude in the beginning.

Maintenance and repair costs are low, even with imported engines of rather indifferent design.

COAL CLINKERING

The clinkering characteristic is one of the factors that determines the relative availability and usefulness of a coal and the operation costs of a boiler house. It requires, however, very close observation and detailed records to be able to separate the troubles and expense due to the ash in the coal from those caused by the burning characteristics of the combustible and the size and the physical condition of the coal as fired.

The clinkering characteristics of coal and the properties of the coal ash have been studied by the Bureau of Mines to determine whether any relationship exists; and the results of this work have been published. A few coals have also been burned in a large heating boiler, these tests showing reasonable concordance with the experimented furnace measurements.

NEW OPERATION *of the* GREAT VALLEY ANTHRACITE CORPORATION

By H. B. Cooley *

General View of Plant (New River in the distance). Mine cars in trip of eight come from slope and cross a steel trestle of 9 ft. span set on 6 percent grade. The rock bin and dump house are seen in the foreground. The washery is located directly under the steel trestle. After being washed coal passes via belt conveyor to sizing screens and storage bins for loading to railroad cars.

THE Valley Coal Field of Virginia has been locally known for many years and the production of Virginia anthracite has been continuous since 1902. The field lies principally in Pulaski and Montgomery Counties and is very interesting to geologists because, though geographically close to the Pocahontas and New River coal fields, the characteristics of the coals are entirely different. Bulletin XXV of Virginia Geological survey (The Valley Coal Field of Virginia, by Marius R. Campbell and others) is an interesting geological study and gives considerable data on this field.

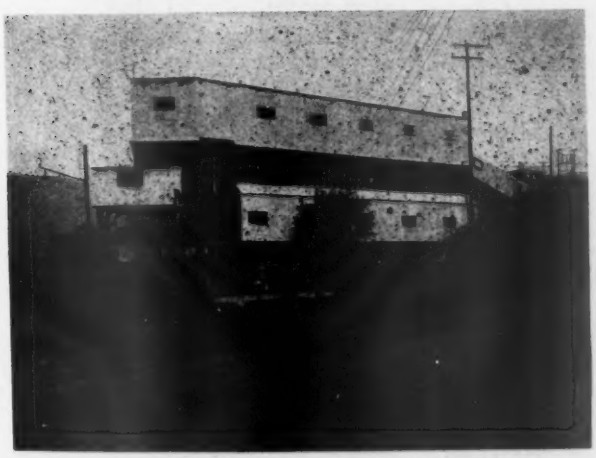
Great Valley Anthracite An Anomaly Lying Contiguous To Pocahontas And New River Fields—Slope Driven On Graduated Pitch —Various Washing Tests To Develop Flow Sheet Here

Some years ago Mr. E. C. Searls, of Chicago, who for many years has operated mines in southern Illinois, became interested in the possibilities of Virginia anthracite, and after very careful investigation of the commercial and operating opportunities offered by the development of the district, he organized the Great Valley Anthracite Corporation. Mr. Searls is president and general manager of the company, and the plant, as described herein, is the result of his own study of the requirements and the conception and design of various units by Allen & Garcia Company, engineers, whom he employed to handle the engineering work.

The mine is located at McCoy, Va., adjacent to the Virginia Railway, at a point where this road parallels the New River. The coal outcrops at this point and the crop line is at right angle to railroad and the river.

After a study of the drill-hole records and geological data available in adjacent workings, it was decided to develop the mine by means of a slope from the outcrop. The tract as located necessitates the construction for economical attack a slope 400 ft. long with a maximum pitch at outcrop of 27 degrees. This slope has now been driven for a distance of 1,700 ft., and there is found to be a gradual reduction

* Allen & Garcia Co., Chicago, Ill.



Sizing and Storage Plant.—After crushing and washing, coal is sized to six grades and stored. As it is drawn off it is rescreened and loaded by means of a rubber belt loading boom.

Ventilating Equipment.—This steel cased downcast fan is set over vertical air shaft which intersects the ventilating slope at a point about 80 ft. below the surface.

in pitch as it advances. The minimum pitch encountered to date is 12 degrees, and 8 degrees is the anticipated minimum for the entire projected length.

Samples of coal taken from adjacent mines were used for making "washability curves" from which results to be expected from cleaning and used to select the process by which "cleaning" was to be accomplished. From the result obtained by "float and sink" tests, together with observation of the burning qualities of the various sizes, it was decided that the larger sizes must be cleaned to a decidedly lower ash content than those of intermediate dimensions. The result of many tests made since the prepared coal has been on the market and in service justifies this original conclusion. For example, the nut and stove sizes, while carrying from 3 to 5 percent ash, are more popular with the domestic trade than the egg size.

The flow sheet, as shown herein, shows how the varying ash content in the different sizes were regulated.

General Plant Layout

The general contour of the surface adjacent to the shaft site lent itself to a very economical washery layout. Directly in front of the slope mouth there was a valley approximately 130 ft. wide by 45 ft. deep, running at right angles to the axis of the slope. Some excavation was necessary to make the sides of the valley fit a washery foundation plan, but it so happened that the railroad grade required a large amount of excess fill, and the entire amount of excavation made for the washery site was used on the railroad embankment.

The coal is brought up the slope in trips of eight pit cars of drop-bottom type, and the hoisting is unbalanced. After the trip emerges from the slope it is pulled over the "knuckle" via a dumping track built to a 6 percent grade. As the cars (still attached to the hoisting rope) continue to move forward, they pass over a rock hopper where any cars loaded with rock that may be in the trip are dumped. Passing on over the rock hopper, the bottom-drop cars discharge their coal load into a 150-ton R. O. M. storage bin. The 6 percent grade is sufficient to overhaul the rope and start the trip in motion when the cars are dumped and the hoist reversed.

From the storage bin the coal is fed by means of a reciprocating feeder to a preliminary sizing screen. The oversize (plus 3½) goes to a double roll crusher and the undersize by-passes same and rejoins the crushed coal at the feed end of the primary screen.

On this screen the 3/16 in. x 0 is removed and is taken by belts direct to a 120-ton capacity bin for loading to railroad cars. The 3½ x 3/16 in. product passes to the washing units, and the plus 3½ in. (crusher oversize) is recrushed.

The main washing unit consists of two 20 in. wide Rheolaveur launders of the sealed discharge type.

Washing in these launders is at a low gravity and only the cleanest coal passes the end of the launders. All heavy gravity material extracted from the Rheo boxes is then screened over 2½-in. bar screen and the 3½ x 2½ material crushed to 2½ in., and remixed with the 2½ in. and under which has passed through the bar screen.

This 2½ in. x 0 high gravity material is then rewashed in a single 20 in. wide three box-type Rheolaveur launder. The gravity in this rewash system is maintained at a higher point than in the two main launders.

In this manner the recovery in the sizes below 2½ in. is increased, and at the same time the ash in the 3½ x 2½ is kept to a minimum.

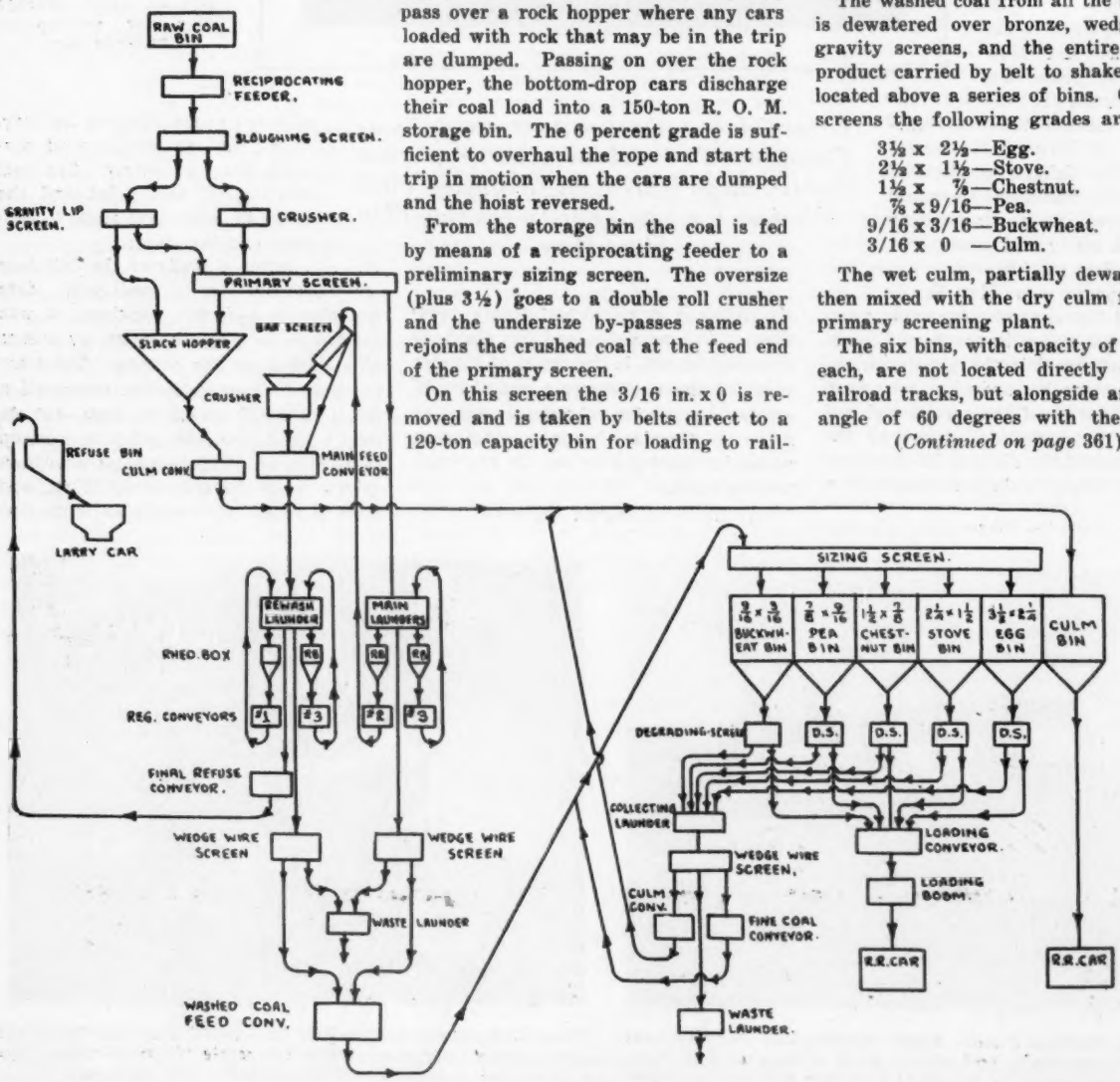
The washed coal from all the launders is dewatered over bronze, wedge wire, gravity screens, and the entire washed product carried by belt to shaker screen located above a series of bins. On these screens the following grades are made:

3½ x 2½—Egg.
2½ x 1½—Stove.
1½ x ⅞—Chestnut.
⅞ x 9/16—Pea.
9/16 x 3/16—Buckwheat.
3/16 x 0 —Culm.

The wet culm, partially dewatered, is then mixed with the dry culm from the primary screening plant.

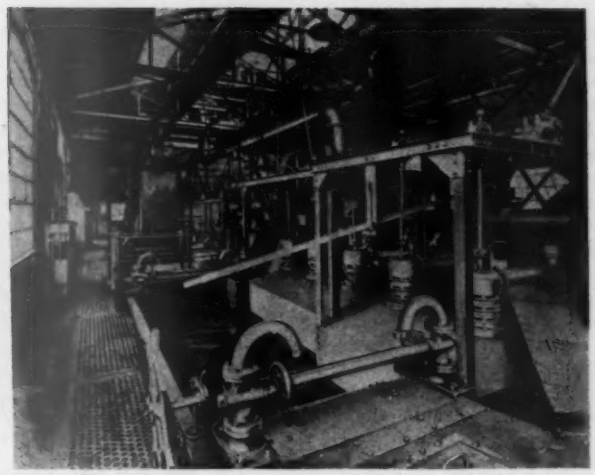
The six bins, with capacity of 125 tons each, are not located directly over the railroad tracks, but alongside and at an angle of 60 degrees with the loading

(*Continued on page* 361)



FLOW SHEET

Simon-Carves plant of the Doncaster Collieries at Yorkshire Main.



Inside arrangement for making 100 tons per hour of metallurgical coal.

BRITISH COAL WASHING PRACTICE

By J. S. DRINKWATER *

Trend Of Industry Toward Utilization Of Fines—Coal Washing Based On Specific Gravity—Ash Content By Sizes Determined—Coal Loss .0572 Ton Per 100 Tons Washed

THE low commercial value of small coal, which gave rise to grave concern among British colliery owners for a period, has now been largely over-come. Today instead of fines being thrown on dumps, as was first the case, this material is now being washed and the refined coal easily marketed at prices which a few years ago were thought impossible.

Many of the small colliery owners who could not finance a washing plant found themselves at a serious disadvantage due to the keen competition introduced with plants that could make a metallurgical coal from dirty slack. Many such pits were closed down or sold.

The abler companies who installed refining plants were able to increase their realizations by the sale of fines, formerly discarded, and varying in amount from 30 to 60 percent of the total output of the mines. When such figures are considered with the high percentage of large stone and refuse brought out of many British mines, one marvels that the mines ever operated with profit.

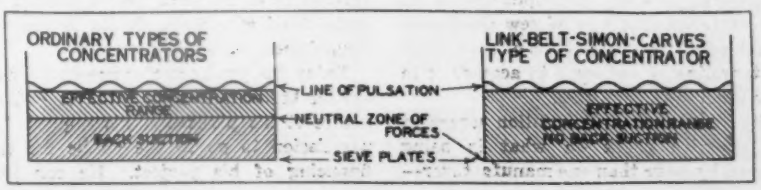
This condition has now been largely removed by the general use of washing plants, prominent among which are the Simon-Carves installations of Simon-Carves, Ltd., at Manchester England. This company first took up the problem in 1903, and during the first 12 years they erected 41 plants with a combined capacity of 3,500 tons per hour. In the second 12-year period this company's installations grew to 135 plants with a total washing capacity of 11,880 tons per hour, and these machines are now in general use in the British fields.

The first principle in the science of coal washing is the hydraulic separation of the waste from the coal; the Simon-Carves method allows the principle of falling bodies to function more readily and with more efficiency in operation than in the old style jig.

To quote figures on gravity with water used as 1, coal varying from 1.27 in some of the best bituminous coals to 1.5 in the anthracite, where stone, clay, earth or slate varying from 1.7 to 2.6; these bodies mixed together are allowed to fall through water. The heavier material will reach the lowest point while the lighter (in this case the clean coal) will settle on top. In the early jig washers this result was desired but not effectively realized, due to a "back suction" from the plungers. This was caused by water rushing to follow the upstroke of the water plungers, thus attracting the whole of the material in the jig box, whether it was coal or dirt. Current design has eliminated the water plunger.

To avoid "back suction" an air piston valve is used in place of the water plungers. Air is admitted at suitable pressure to lift the material in the jig box. Immediately following this operation the air pressure is reduced to atmospheric but, with the flow of the water to the jig box remaining entirely uniform, there is no "back suction." The air already forced into the box acts as a cushion and thus enables the falling particles to separate as respectively ordered by gravity.

It is, of course, well known that the velocity of fall was always considered as proportional to the diameter of the particle and the difference between the specific gravity of the substance and of water, size, shape, and porosity having been considered.



* Consulting Engineer, Simon-Carves, Ltd., Manchester, England.

On the water jig type this still obtains due to the combination of suction and gravity giving limited scope for separation. With the air type of jig the difference in velocity fall as applied to the various sizes is so minute that it has been found preferable to wash the several sizes in one common jig and to only rewash the fines (½ in. and below) used for coking purposes, where more intensive washing is needed.

It is now general practice to wash from 3 in. to 0 in volumes up to and over 100 tons per hour in one jig box.

The diagram on page 337 clearly shows the relative merits of the respective types of jigs and that while the air jig has the advantage of 100 percent gravity concentration range, the water jig is only approximately 45 percent effective. For the water jig the coal must be correctly sized before washing starts.

The advantages claimed for the air jig over the water jig are the following:

Fewer washing boxes, unit capacity of 100 tons per hour, uniform sizing after washing, satisfactory operation on fines, cheaper operation and the absence of air cushioning and pounding of material in the jig box. The plant is not complicated, but has simple manipulation and control. It has a relatively small number of working parts and makes an ideal machine for coal handling.

A recent washing test of a Simon-Carves washery at the plant of the Coltness Iron Company, Ltd., Newmain's, Lanarkshire, coal varying in ash from 8 to 16 percent was passed unscreened through one washer box, the resultant ash being:

Size of coal	Ash content
2¼" to 1⅝"	4.0%
1⅝" to 1"	4.1%
1" to ½"	4.9%
½" to 3/16"	5.0%
3/16" to 0"	5.9%

The ½ in. to 0 size was rewashed in one washer box. The 3/16 in. to 0 includes the whole of slurry recovery from the water settling tank. Coal lost with refuse on this test was equal to 0.0572 ton for each 100 tons washed.

ANNUAL CHECK-UP ON PROGRESS

(*Continued from page* 324)

tions discussed from his, the operator's, own viewpoint at the meetings of practical operators.

Within one week one can secure a knowledge of the accomplishments of successful applications of new machinery which would require months of time spent in traveling if one were to acquire it in any other way than this.

Moreover such an exposition serves as an effective check on what is being offered by more than one manufacturer—making minute comparisons of competitive products. With more than a million dollars' worth of new equipment on display, an attendance of operators from every coal field in America, there can be no reason for isolating one's problems. More than one operator or manufacturer may have experienced and overcome the same difficulties with which you now are beset. You will find here a most excellent opportunity to talk it over and perhaps solve it. As for the expense of your trip, just remember one new idea will pay dividends for years.

CALIFORNIA MINERAL INDUSTRIES

(*Continued from page* 323)

but they are scarce. Their elimination is not altogether a problem to be solved by legislation. Education is necessary—education of the investor. To that end I and those associated with me are striving, and, I believe, with a splendid measure of success.

The records of the department show that with each passing month the number of investors who insist upon receiving proof that stock is legally issued and who examine closely any proposition before investing in it, is increasing. The department has three offices, Los Angeles, San Francisco and Sacramento. Figures for the Los Angeles office alone, which have just been compiled, show that during March, 1927, my first month as Commissioner, 20 persons called at the office to discuss investments—to investigate. In the same month letters were received at the same office from 10 persons. Since then the number has shown a splendid upward trend, the peak for consultations being reached in January of this year, with 297, and, for letters of inquiry, in February, when they numbered 128. The totals for the 12 months, March 1, 1927, to February 29, 1928, were 1,940 personal inquiries and 574 letters. I believe similar results will be shown for the other offices when statistics are completed.

During the same period we have been conducting what might be termed a campaign of confidence. We have sought, with good results, to impress upon the minds of men who have projects to promote that this department was established to assist them in any plans that are legitimate. Our efforts in this direction cover all lines of business, but particularly the mining game, for here we find a class of men who, because of unrestriction in the past, find it difficult to understand why there should be regulation of their enterprises now.

Today the prospector or promoter may appear before this department and place before it his plans and his request for permission to go to the public for the financing of his project. He can feel assured of every consideration, if he is sincere and frank. With his permit in hand he can go to an investor and say, "The stock you purchase will be legally issued. There may be a risk in this investment, but I am going into it with you—50-50, as was the custom when the keeper of the general store grub-staked me back in the old days."

To the investor, this department is seeking to impart information that may prevent him from becoming the victim of frauds.

To the candid and honest prospector or promoter of mining ventures we earnestly are trying to show that we have a keen and sympathetic understanding of his problems and are ready to aid him in what he is striving to accomplish.

To my mind there is a personal touch here that can be applied only by those who know California and who understand the spirit and ideals of the great West—but which is impossible under the harsh requirements and enforced regard for detail peculiar to a Federal bureau.

LEGISLATIVE REVIEW

(*Continued from page* 327)

the employment of railroad workers for more than six consecutive days per week and for not more than 13 consecutive days in an emergency. It would allow workers four days of rest per month, without decrease of monthly rate of pay. Interstate Commerce.

Railroad Rates

S. 1263. This bill forbids a railroad from charging more for a short haul than for a long haul. Reported by Interstate Commerce Committee.

H. R. 12692. Mr. Peery (Dem., Va.). This bill bases freight rates on the cost of the service to railroads and forbids the Interstate Commerce Commission from increasing railroad transportation rates beyond that cost or from decreasing rates to that cost. Interstate Commerce.

S. 3922. Mr. Glass (Dem., Va.). This bill bases railroad transportation rates on the cost to the railroad of the service performed, the value to shippers and their sufficiency to yield the railroads a fair return. Interstate Commerce. This and the foregoing bill were prompted by the recent refusal of the Interstate Commerce Commission to allow railroads to reduce rates on coal from Southern mines to Lake ports.

H. R. 12356. Mr. Andresen (Rep., Minn.). This bill provides for transportation service by the Inland Waterways Corporation on the Minnesota and St. Croix Rivers. Interstate Commerce.

S. 742. This bill establishes foreign trade zones in American ports of entry. Reported by Senate Commerce Committee.

POSSIBILITIES *of* RESEARCH *on* NON-CORROSIVE METALS *for* HANDLING COAL MINE WATER

By W. A. SELVIG[1]

It Is Desirable In Selecting Drainage Equipment To Know What Is The Corrosive Action Of Mine Water On Various Metals And Alloys. This Paper Reviews Briefly The Results Of Corrosion Tests With Acid Mine Water As Conducted By The Writer And Considers The Possibilities Of Such Methods Of Testing

ALTHOUGH ground waters are normally alkaline, analyses of waters from coal mines show that the original ground water has changed considerably and contains relatively large amounts of ferrous and ferric iron and free sulfuric acid. In such waters the salts are present chiefly as sulfates.

The occurrence of iron sulfates and free sulfuric acid in acid mine water is explained by the action of water and air on the pyrite (FeS_2) associated with the coal or the overlying strata. Pyrite is readily oxidized to ferrous sulfate, $FeSO_4$; ferric sulfate, $Fe_2(SO_4)_3$; and sulfuric acid, H_2SO_4. The reactions may be represented as follows:

$$2FeS_2+7O_2+2H_2O=2FeSO_4+2H_2SO_4; \quad (1)$$
$$4FeSO_4+2H_2SO_4+O_2=2Fe(SO_4)_3+2H_2O; \quad (2)$$

In describing the acidity of mine water the terms "free acidity" and "total acidity" are used. By "free acidity" is meant the amount of free sulfuric acid present. The term "total acidity" includes free sulfuric acid plus sulfates of iron and aluminum. Free acidity and total acidity can be determined by simple titration methods.[2] Iron sulfate in the form of ferrous sulfate oxidizes readily to ferric sulfate, which is strongly oxidizing and is an important factor in the mechanism of corrosion of metals by mine water.

All acid mine waters from coal mines contain ferric sulfate in addition to free sulfuric acid. The combination of free acid, together with an oxidizing substance such as ferric sulfate, makes a highly corrosive water. Some metals may be quite resistant to low concentrations of sulfuric acid alone yet will corrode rapidly in acid mine water, because of the action of the strongly oxidizing ferric sulfate. For this reason it is not safe to assume that a metal which has proved satisfactory in low concentrations of sulfuric acid will be satisfactory for use in mine water. For a scientific discussion of the effect of acidity and oxidation capacity on corrosion of metals in acid mine water, the work of Hall and Teague[3] should be consulted.

The degree of acidity of coal-mine waters varies considerably. Waters from the mines of western Pennsylvania, with which the writer is the most familiar, are practically always acid. According to Crichton[4] only four out of more than 300 mines examined in central Pennsylvania had alkaline waters. The alkalinity of these four waters was considered to be due to the contact of limestone with the coal beds.

In 1921, Enos and the writer[5] made corrosion tests of metals in acid mine waters from three mines in western Pennsylvania. Table 1 gives the acidity of these waters during the period of test:

TABLE 1—Acidity of Water From Three Mines of Western Pennsylvania

Mine	Period, months	Acidity due to free sulfuric acid. Parts per million*			Total acidity due to free sulfuric acid plus sulfates of iron and aluminum, parts per million		
		Lowest	Highest	Average	Lowest	Highest	Average
Calumet	3	270	660	430	2,180	3,710	2,950
Montour No. 1	4	530	2,480	1,430	8,870	18,160	11,360
Edna No. 2	4	1,100	3,200	2,160	11,270	17,200	14,160

* To convert parts per million to grains per U. S. gallon, multiply by 0.0583.

From the table it is seen that the acidity may vary considerably from time to time in individual mines. By subtracting the values for free sulfuric acid from those for total acidity, values are obtained for the amount of sulfates of iron and aluminum present. These sulfates are a potential source of free acid in any process of neutralization whereby the free sulfuric acid is destroyed, as they are capable of reacting with water to give free acid and hydrous aluminum and iron oxides; the latter is the familiar yellow-brown substance deposited from mine drainage in surface streams when the free acid in the mine drainage is neutralized by the alkaline surface water.

Corrosion Testing Methods

Two different plans of corrosion testing may be considered: (1) Laboratory or field tests, where the action of the water upon test specimens of the metal or alloy is examined; and (2) service tests, where the corrosion of parts in actual use is observed. In service tests the material is tested under actual conditions of use; although obviously the ideal way of testing, this is a costly process and permits the testing of only a limited number of metals.

Considerable experimental work has been done in recent years on accelerated laboratory methods of corrosion testing,[6] as the making of accelerated laboratory tests would be desirable if the results could be correlated with actual service results. Apparently such accelerated methods of test have not been sufficiently developed to interpret the results in terms of actual service.

The writer believes that the best plan is to immerse test specimens of various metals and alloys in flowing mine water at a number of mines which yield waters covering a wide range of acidity. Such tests will eliminate metals that are corroded rapidly and will leave a group of corrosion-resistant metals that can be further tested under actual service conditions by fabrication into mine-drainage

[1] Associate Chemist, Pittsburgh Experiment Station, U. S. Bureau of Mines.

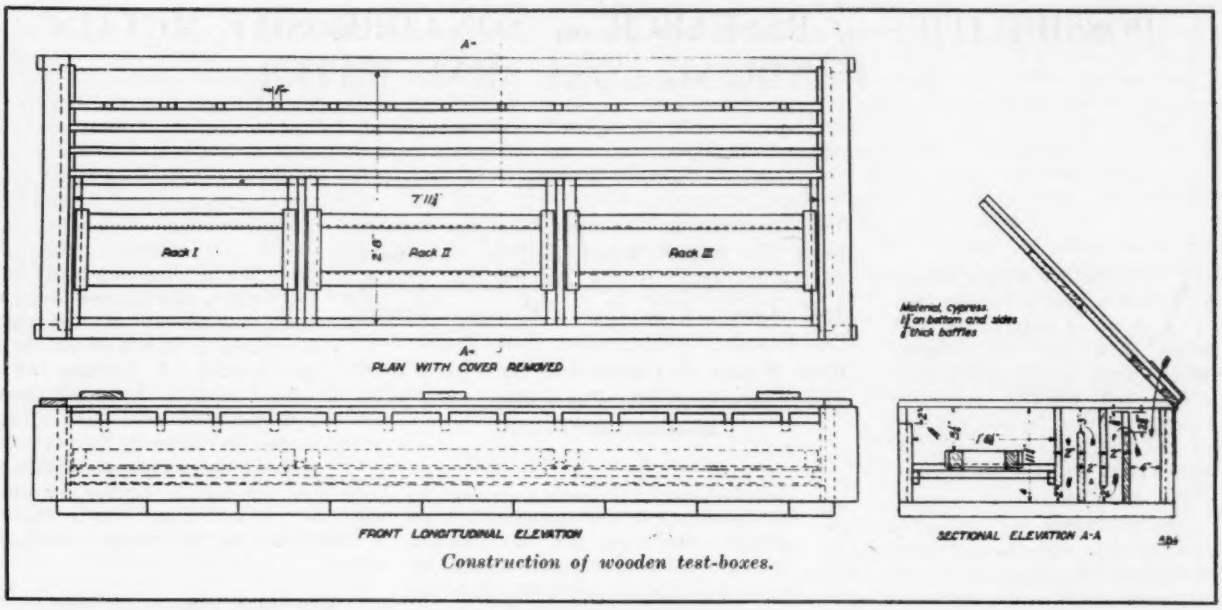
[2] Selvig, W. A., and Ratliff, W. C., The Nature of Acid Water from Coal Mines and the Determination of Acidity. Ind. & Eng. Chem., vol. 14 (1922) pp. 125-127.

[3] Hall, R. E., and Teague, W. W., The Effect of Acidity and Oxidation Capacity on Corrosion of Metals and Alloys in Acid Mine Water. Bull. 15, Coal-Mining Investigations, Carnegie Inst. of Tech. 1924, 62 pp.

[4] Crichton, A. B., Mine Drainage Stream Pollution. Trans. Amer. Inst. of Min. and Met. Eng., vol. 69 (1923) p. 438.

[5] Selvig, W. A., and Enos, G. M., Corrosion Tests on Metals and Alloys in Acid Mine Waters from Coal Mines. Bull. 4, Coal-Mining Investigations, Carnegie Inst. of Tech. 1922, 71 pp. (out of print).

[6] Anderson, R. J., Enos, G. M., and Adams, J. R., Accelerated Corrosion Testing of Metals and Alloys in Acid Mine Water. Bull. 6, Coal-Mining Investigations, Carnegie Inst. of Tech. 1923, 61 pp. See reference 4. Report of Committee B-3 on Corrosion of Non-ferrous Metals and Alloys. Proc. A. S. T. M., vol. 27, part 1, 1927, pp. 281-298.



Construction of wooden test-boxes.

equipment. If a metal fails when simply immersed in flowing mine water, it need not be further tested under the more severe conditions of use which subject it to wear and erosion from gritty material in the water. Such immersion tests were conducted by Enos and the writer[7] with satisfactory results. A brief outline of the tests and the results obtained are presented.

Immersion Tests

About 50 metals and alloys were tested by immersing test specimens in flowing mine water at the three mines mentioned in Table 1. The test specimens were rectangular pieces 2 by 6 in. in size, the rolled materials being approximately 16 gage (B. & S.) or 0.051 in. in thickness, and the cast materials approximately ¼ in. in thickness. The specimens were surfaced by machining, grinding, or polishing with fine emery cloth to remove all surface products formed during their fabrication. After surfacing, each test piece was carefully measured and weighed. Three test pieces of each material were tested at each of the three mines.

The test boxes for making the corrosion tests were designed to permit total immersion of the test pieces in flowing water. The boxes and racks for holding the specimens were made of wood. A system of baffles was built in the boxes to obtain a uniform flow of water around each specimen. Figure 1 shows the construction of the test boxes and racks. The slots for holding the test specimens in the racks were cut so as to allow a ¾-in. spacing between the faces of the specimens.

Mine water was conducted to the boxes by means of a rubber hose. The rate of water flow was so regulated as to change the water content of each box once in every 15 minutes. Under these conditions the velocity of water flow around the specimens was 1.8 in. per minute. It is important in such comparative tests to have the velocity of water flow the same for all the test specimens, as the rate of corrosion increases with the velocity of flow. The rate of flow was kept constant throughout the test by inserting a wooden plug with a circular orifice into the rubber hose. The boxes were carefully leveled so that the overflow would be uniform over the entire length of the box.

Inspections were made at each mine at intervals of one to two weeks, depending on the apparent rate of corrosion at the three mines. At each inspection each test specimen was removed, and the nature and extent of corrosion were noted. The specimens were rinsed in water, and any corrosion products which could be rubbed off with the hand were removed. The temperature of the water in the test boxes was taken, and samples of water were collected for determination of acidity.

Test specimens that had corroded through or corroded away at the edge for a depth of about ¼ in. were considered to have failed, and were removed; also, specimens were removed if they had corroded uniformly thin so that they might fall out of the racks before the next inspection.

Test specimens that had failed during the test, and all specimens that remained throughout the test, were given the same treatment after removal from the mine water. They were carefully washed in warm water and rubbed with a fiber brush to remove loose surface coatings, after which they were dried and weighed. The loss in weight per unit area per day was calculated for each material.

No satisfactory method of expressing results of comparative corrosion tests has been standardized. Some materials develop serious local pitting and yet may show a small loss in weight, whereas other materials corrode uniformly with no pronounced pitting and their loss in weight may be relatively large. The density of the material must be considered in comparing loss-in-weight figures of light materials, such as aluminum, with those of heavy materials. By considering the loss in weight per unit area and the nature of corrosion, whether uniform or irregular, a fair comparison may be made as to the relative worth of the different metals and alloys for resisting the corrosive action of acid mine water.

Results of Immersion Tests

The test specimens showed a different loss in weight in each of the three mines, as would be expected from the difference in the acidity of the waters. Corrosion was the greatest in the highly acid water of the Edna mine and least in the Calumet mine, which had the least acid water. Pure nickel showed only a very little corrosion in the water of the Edna mine, but was considerably corroded in the less acid waters of the Montour and Calumet mines. Table 2 gives the designation, approximate composition, and approximate loss in milligrams per square centimeter per day of the metals and alloys exposed in the Edna mine water.

[7] See reference 5.

TABLE II—Designation, Approximate Composition, and Loss in Weight Per Unit Area Per Day, in Mine Water From Edna No. 2 Mine

Designation	Chemical Composition, percent	Approximate loss, milligrams per sq. cm. per day
Brasses		
Rolled high brass	Cu, 66.55; Zn, 33.45(a)	7
Rolled low brass	Cu, 80.09; Zn, 19.91(a)	7
Rolled naval brass	Cu, 60.40; Sn, 0.77; Zn, 38.83a	7
Rolled brass (Admiralty metal) grain size, 0.025 mm.	Cu, 70.80; Sn, 1.14; Zn, 28.06	7
Rolled brass (Admiralty metal) grain size, 0.035 mm.	Cu, 71.38; Zn, 27.36; Sn, 1.26	6
Rolled brass (Admiralty metal) grain size, 0.075 mm.	Cu, 71.46; Zn, 27.42; Sn, 1.12	6
Rolled brass	Cu, 57.95; Pb, trace; Sn, 0.47; Fe, 0.55; Zn, 41.02	7
Manganese brasses		
Cast manganese brass	Cu, 68.05; Zn, 27.89; Fe, 1.55; Pb, 0.45; Mn, 2.06	3
Cast manganese brass	Cu, 67.45; Zn, 28.84; Fe, 1.48; Pb, 0.28; Mn, 1.95	4
Rolled manganese brass	Cu, 67.10; Zn, 29.64; Fe, 0.97; Pb, 0.30; Mn, 1.99	4
Rolled manganese brass	Cu, 65.5; Pb, 0.5; Zn, 30.5; Mn, 2.2; Fe, 1.3	4
Bronzes		
Cast bronze	Cu, 89.8; Sn, 9.7; Pb, 0.5	2
Rolled bronze	Cu, 98.51; Sn, 1.49	7
Rolled phosphor bronze	Cu, 94.4; Sn, 5.5; P, 0.1	5
Rolled leaded phosphor bronze	Cu, 89.8; Sn, 5.6; Pb, 4.6; Fe, trace; P, trace	2
Cast leaded zinc bronze	Cu, 86.34; Pb, 0.83; Sn, 11.24; Zn, 1.60	1
Cast leaded bronze	Cu, 74.9; Pb, 14.3; Sn, 10.5	1
Cast leaded bronze	Cu, 87.5; Sn, 10.6; Pb, 1.6	3
Cupro-nickels		
Rolled cupro-nickel (coin metal)	Cu, 74.60; Ni, 25.40	7
Rolled cupro-nickel	Cu, 84.36; Ni, 15.64	7
Cast leaded cupro-nickel	Cu, 53.57; Ni, 25.30; Fe, 0.61; Pb, 19.58; Sn, 0.56	4
Cast chromium-iron cupro-nickel	Cu, 42.24; Cr, 11.89; Ni, 35.00; Si, 1.50; Fe, 9.35	7
Cast iron-manganese cupro-nickel	Cu, 71.16; Fe, 7.47; Ni, 19.01; Mn, 2.35	7
Nickel Silvers		
Rolled nickel-silver	Cu, 63.78; Zn, 17.68; Ni, 18.54(a)	7
Rolled iron-nickel-silver	Cu, 66.03; Zn, 23.99; Ni, 9.92; Fe, 0.06	7
Rolled nickel-silver	Cu, 52.79; Zn, 34.58; Ni, 12.63	7
Cast silicon-nickel-silver	Cu, 72.3; Ni, 16.5; Sn, 3.5; Zn, 7.4; Pb, 0.3; Si, trace.	7
Cast tin-lead nickel-silver	Cu, 63.52; Ni, 12.85; Sn, 4.59; Zn, 11.55; Pb, 7.49	4
Cast tin-lead nickel-silver	Cu, 54.32; Sn, 2.54; Zn, 16.33; Pb, 6.30; Ni, 20.51	4
Copper-lead Alloys		
Cast copper-lead alloy	Cu, 53.4; Pb, 46.4	4
Cast copper-lead alloy	Cu, 68.0; Pb, 31.9	5
Cast copper-lead alloy	Cu, 73.01; Pb, 26.96	5
Aluminum Alloys		
Cast aluminum-silicon alloy	Si, 3.90; Al, 96.1; (Al by difference)	2
Cast aluminum-manganese alloy	Mn, 1.81; Al, 98.19; (Al by difference)	2
Rolled aluminum-manganese alloy	Mn, 0.95; Fe, 0.95; Si, 0.53; Al, 97.57 (Al by difference)	2
Rolled aluminum alloy	Cu, 3.62; Mn, 0.46; Fe, 0.45; Si, 0.56; Al, 94.91; (Al by difference)	2
High-silicon cast irons		
High-silicon cast iron, A	Si, 14.50; C, 1.45	5
High-silicon cast iron, B	Si, 13.80; C, 0.76	0.00374
Rustless Steel		
Rolled high chromium steel	Cr, 29.5; Mn, 0.27; Si, 0.53; C, 0.36; Fe, balance	0.00030
Rolled alloy steel	Ni, 23.87; Cr, 12.96; Si, 3.40; C, low; Fe, balance	0.00015
Rolled alloy steel	Ni, 29.60; Si, 3.26; Cr, 10.73; C, low; Fe, balance	0.00074
Miscellaneous Metals		
Rolled pure ingot iron	Fe, 99.9(a)	7
Rolled pure aluminum	Commercially pure aluminum(a)	2
Rolled pure copper	Commercially pure copper(a)	7
Rolled pure nickel	Ni, 99.+	0.00299
Miscellaneous Alloys		
Cast aluminum bronze	Cu, 93.9; Al, 6.1 (Al by difference)	5
Rolled iron-aluminum bronze	Cu, 86.23; Fe, 4.81; Al, 8.96 (Al by difference)	6
Rolled monel metal	Ni, 65.1; Cu, 30.52; Fe, 4.2	4
Cast high-lead alloy	Pb, 96.1; alkaline earth metals balance	Gained Weight
Rolled copper-manganese-iron alloy	Cu, 94.81; Mn, 4.52; Fe, 0.67	7
Rolled nickel-chromium-iron alloy	Ni, 52.50; Al, 0.20; Cr, 9.29; Si, 0.19; Mn, 1.24; Fe balance	7
Rolled nichrome	Ni, 5744; Si, 0.55; Cr, 9.37; Mn, 1.75; Fe, balance	0.01812

Corrosion of Brass

Table 2 shows that the alloys of the brass type, containing considerable amounts of zinc, were corroded extensively. As zinc is dissolved rapidly in low concentrations of sulfuric acid, apparently it is an undesirable metal to use in alloys for mine water. All of the brasses were uniformly corroded and showed a large loss in weight. The manganese brasses, although they showed a lower loss in weight than the regular brasses, are probably no better for use in mine water, for they became very brittle. As corrosion proceeded, the zinc was largely removed and left behind a brittle copper-rich material.

Corrosion of Bronze

Some of the bronzes listed in Table 2, although corroded, showed up much better than the brasses. As bronzes are used fairly extensively in pump parts, it is interesting to note that those containing relatively high amounts of tin, or lead and tin, are fairly resistant to acid water. In any future tests the various available bronzes and leaded bronzes should be investigated.

Corrosion of Cupro-Nickel, Nickel Silver, and Aluminum

The cupro-nickels and nickel silvers tested were corroded extensively and are apparently not suitable for drainage equipment. Although the loss-in-weight figures for aluminum and the aluminum alloys tested are comparatively low, these materials are not considered of value because all of the test specimens pitted extensively and rapidly when immersed in the water. On account of the lightness of the aluminum alloys, the loss-in-weight figures represent a higher percentage of the original material than would similar figures for the heavier metals and alloys.

Corrosion of Copper-Lead Alloys

The three copper-lead alloys were more resistant than the brasses, cupro-nickels, and nickel silvers, but not as resistant as the bronzes. This type of alloy should be included in any future tests.

Corrosion of Rustless Steel

Under the class of rustless steel are three alloys which were very resistant to corrosion by the acid mine waters. They gave only a negligible loss in weight, and at the end of the test showed practically no signs of corrosion. Two of these alloys were highly alloyed chromium-nickel-silicon steels and the other was a high chromium steel. In recent years there has been considerable progress in the development of chromium-iron alloys, and no doubt a number of such alloys are now available for testing.

Corrosion of Nichrome and High-Silicon Iron

A nichrome and a high-silicon cast iron gave a very small corrosion loss. The 96 percent lead alloy listed in Table 2 actually gained in weight, but the surface was blistered and cracks had formed in the ends, so that it can not be recommended for use.

Economic considerations, such as cost, ease of fabrication, and physical properties, are important factors in determining the suitability of a metal or alloy for use in mine-drainage equipment; these factors determine whether the material will be practical for use. Materials that are corrosion-resistant when immersed in flowing mine water should be tested under the more severe conditions of use where they are subjected to wear and to the abrasive action of gritty material in the water. It is not sufficient that the metal be resistant to corrosion, because to be industrially feasible it should be a good foundry metal and suitable for machining. Obviously, the metal should possess the definite physical properties requisite for its intended use in mine-drainage equipment.

SAFETY AT MADISON COAL CORPORATION

(*Continued from page* 314)

technical study of the principles of first-aid and mine rescue work, as well as of the different instruments used therein.

Safety meetings are held by the supervising officials of each mine at regular intervals, and every three months a general safety conference is attended by some of the supervising officials from each mine, the attendance being arranged in rotation so as to give each one a chance to attend in turn without unduly handicapping the regular operation while they are away. In this manner the horizon of each is broadened by contact with men from other properties, all of whom, though frequently working under different conditions, are striving for the same end.

Practical Results

While the promotion of safety work is sometimes disappointing because it is seldom possible to point definitely to accidents it has prevented, yet few would contend that it is any other than effort well expended in the right direction. Its humanitarian value is unquestionable, and when consistently followed up, its benefits are certain to be reflected in the cost sheet.

It has given us a body of approximately 2,000 men who have received first-aid training, together with a smaller, intensively trained organization at each mine fully competent to act promptly and efficiently in the case of any disaster involving life or property, many hours before the state or federal rescue teams could reach the scene.

The training given the men undoubtedly tends to impress them with the every-day hazards of their occupation, and this in itself has always been notoriously difficult of accomplishment. It also teaches them how an accident may be prevented, and there is no better way to impress it on the mind of a worker, nor a more opportune time to do it, than when demonstrating how to take care of any certain accident.

A very practical demonstration of the value of the training is given the men below on the occasions when a man is seriously injured. The efficient and workmanlike manner in which the first-aid men prepare him for removal, thereby insuring handling with minimum suffering and shock, and greatly enhancing his chances of recovery, forms an impressive exhibit in itself. Three cases in mind well illustrate this point.

The first was a machine runner who suffered a severe electrical shock, and the men who were working with him, not being trained in first-aid, thought the man was actually killed and so reported. There happened, however, to be two first-aid men in the immediate vicinity of the accident. They immediately began to apply artificial respiration, and worked with the injured man until he was revived sufficiently to walk out of the mine. He lost only three days work, and owes his life to the quick and efficient work of his first-aid trained associates.

The second case was a timberman who was lifting a heavy bar and in some way came in contact with a trolley wire carrying 250 volts. This man was also severely shocked and rendered unconscious, but the man with whom he worked happened to be trained in first-aid. He immediately proceeded to give artificial respiration and continued at it until help arrived. Undoubtedly this man would have died had he not had the assistance of the man whose training enabled him to do the right thing without hesitation.

The third case was a trip-rider who was thrown under a trip of empty cars, having his hand and arm badly crushed. A first-aid man with ample supplies was close at hand. The injured man's wounds were bound up and he was made as comfortable as possible before he was removed from the place of accident. When he was brought out of the mine the doctor was so well pleased with the bandaging that he ordered him taken to the hospital before giving any further treatment other than a hypodermic as a stimulant, because he was suffering severely from shock. This boy is alive today, with no more than a 25 to 50 percent loss of use of the arm.

In sad contrast to the above another boy was injured at almost the same hour at another mine in the same district, and by a strange coincidence the injury was to the same arm. Both boys were brought to the same hospital. Surgeons who saw both cases stated that our employe, if anything, was the most severely injured. The other boy, however, did not have the advantage of a well-trained first-aid man at hand, and was brought into the hospital suffering from severe shock and much loss of blood, and died in a few hours.

Such experiences make us feel that it is well worth while, both from a humanitarian and financial standpoint, to train every employe who works in or around the mines in first-aid work. It also tends to create a better feeling between the employes and the management. They get a better understanding of each other, and the men come to realize that the company has their interest sincerely at heart, and is trying to make the hazardous occupation at which they work as safe for them as possible.

In a strictly material way also have the results been of substantial nature. Prompt handling of incipient fires on the surface has more than once prevented extensive damage to plant and equipment, and by having trained rescue men and proper equipment available for handling underground fires when they are first discovered, and promptly extinguishing same, or at least localizing the territory affected, much property damage and loss of operating time has been averted.

REDUCING ACCIDENTS FROM BLASTING CAPS

(*Continued from page* 316)

the manufacturers of explosives and the users of explosives in the fact that all desire earnestly that there be a lessening of all accidents. It would seem that an unusual opportunity is presented for a joint effort in this campaign to reduce the number of accidents to children from playing with blasting caps. If they are kept out of reach of the children the accidents will automatically cease. Mining companies have an opportunity to do their part by bringing the matter to the attention of their men. In fact, this cooperation is widely needed at the present time in the movement because the explosives manufacturers have adopted every possible means to bring the seriousness of the matter to the attention of users, and also to the attention of parents and teachers, by one of the widest campaigns of safety ever undertaken in the schools. The picture also has been shown to Boy Scouts and safety meetings, and there are numbers of men who are taking such an active interest in the campaign in their communities that they are personally devoting their time and, in some cases, hiring operators to go about among the schools and at community meetings to teach the doctrine. If the mining companies would see to it that all their employes are properly warned, it would undoubtedly have an excellent effect in lessening these accidents.

Literature from the Institute of Makers of Explosives is available to a certain degree, as is also the showing of the film for schools and community houses which are near the mines.

BETHLEHEM SAFETY RECORD

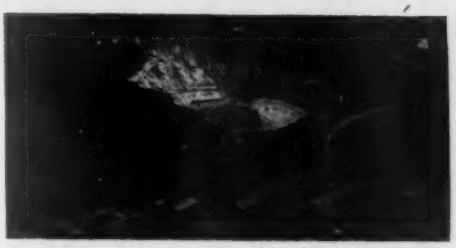
Marked improvement in accident prevention was effected by employes of Bethlehem Steel Corporation in the first quarter, the corporation, as a whole, having raised its previous best record by 17.8 percent. The steel plants alone bettered their safety record by 44 percent. The Maryland plant group won first prize of $1,000, with an improvement of 70.3 percent. The Steelton plant group won second prize of $500, with a 62.4-percent improvement, and the Bethlehem plant group won third prize of $250 by bettering its record by 59.8 percent.

PRACTICAL OPERATING MEN'S DEPARTMENT

METALS

GUY N. BJORGE
Editor

Practical Operating Problems of the Metal Mining Industry



MINING METHODS *at the* PILARES MINE

By V. A. BRUSSOLO *

Mining Of Scattered Lenticular Ore Bodies Described—Mineralization Most Intense At Perimeter—Chalcopyrite Principle Gangue —Four Compartment Shaft Used—Mucking Operation Cycle Determined—Raises And Drives On Contract—Stoping Methods In Detail—Explosives And Timber Cost Segregated — Waste Filling Adopted — Safety Practice

THE Pilares mine of the Moctezuma Copper Co. is situated in the northern part of the state of Sonora, Mexico, approximately 75 miles south of the international boundary, at an altitude of about 5,000 ft. The mine is reached from Douglas, Ariz., by railroad to Nacozari; thence by an 8-mile narrow gauge to Pilares.

GEOLOGY

The Pilares mineralized zone —Figure 1—is roughly of the shape of a cylindroid, elliptical in outline in a horizontal plane, containing scattered ore bodies at the perimeter and central portion of the oval. The ore bodies are designated locally as Wall and Core ore bodies, respectively, according to their location in the oval. Wall ore bodies exceed numerically Core ore bodies, for the mineralization has been more intense at the perimeter of the oval than at any other point. Generally, Wall bodies are confined within well-defined waste boundaries, whereas in Core bodies there is a gradual change from ore to waste.

The rocks found in and around the mine are latite breccia, andesite breccia, and monzonite, and diabase which occurs as a dike from top to bottom of the mine. Within the oval the latite breccia extends from the surface to a point roughly midway between the 900 and 1,000 levels. The andesite follows below the latite, the contact between the two rocks being roughly semicircular, the lowest point occurring close to the center of the oval. The rocks outside the oval consist of latite breccia from the surface to the 300-ft. level, and below this point of monzonite. Several major faults cut through the deposit, a structural feature which probably has had much to do with the distribution of the ore.

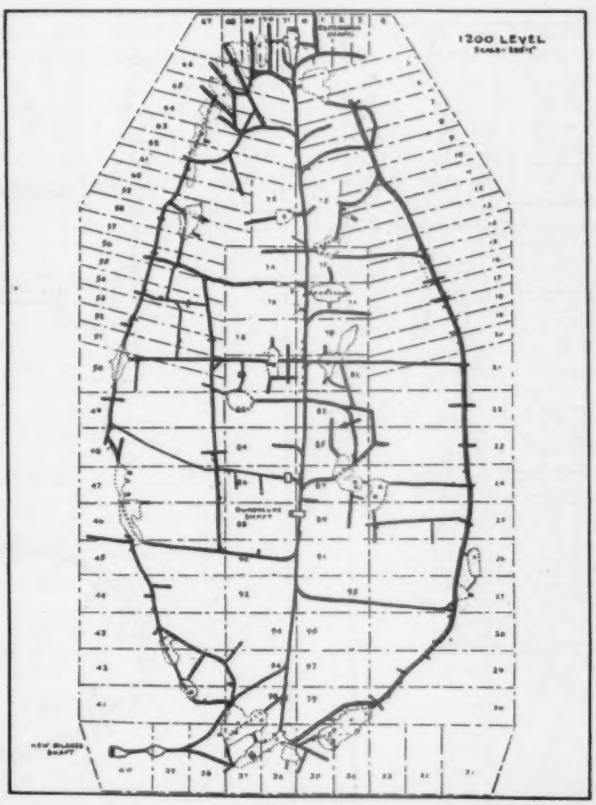


Figure 1

The chief mineral mined at present is chalcopyrite. It is intermixed with varying amounts of pyrite and waste rock, the whole showing a characteristic breccia structure. The brecciated appearance of the ore shows conclusively that fracturing has been responsible for both the extent and the location of the ore bodies. Generally, with increasing depth there is a diminishing in the amount of brecciation and a corresponding decrease in the area and degree of the mineralization. The Pilares ore bodies are on the whole of medium to low copper content, the average grade not exceeding 2.65 percent copper.

EXPLORATION AND DEVELOPMENT

Level Interval

The level interval is of 100 ft.; the lower levels, which are

* Assistant Superintendent, The Moctezuma Copper Co.

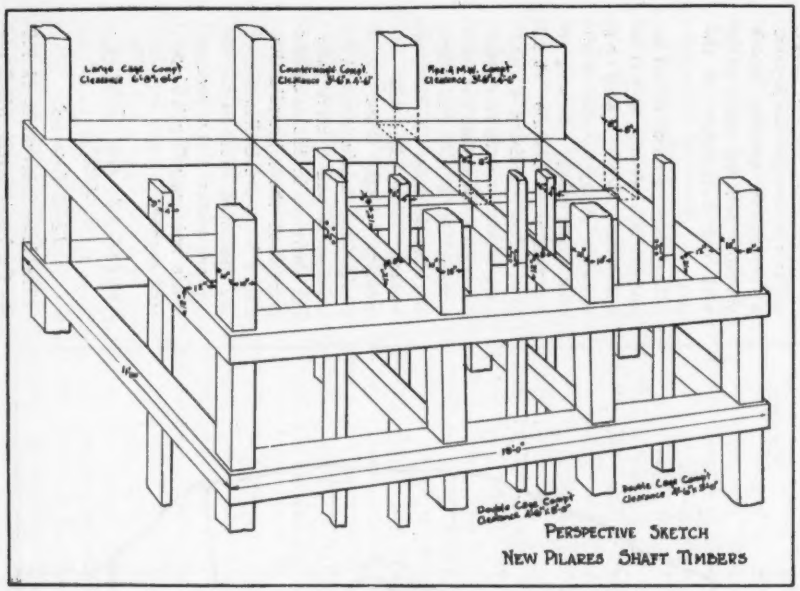


Figure 2

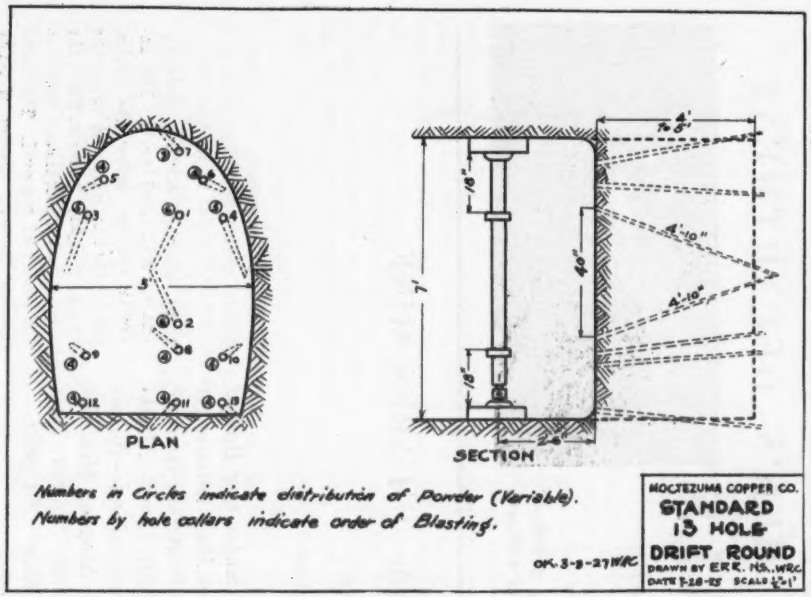


Figure 4

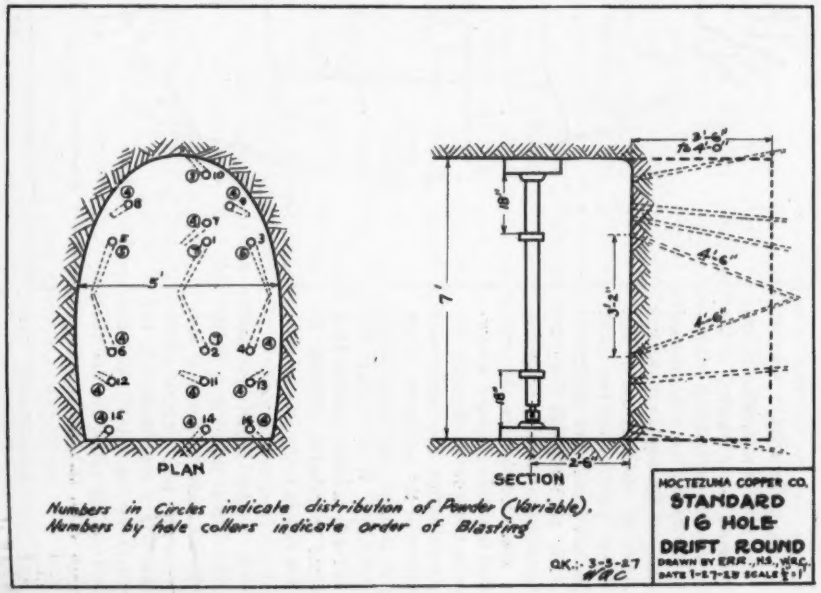


Figure 5

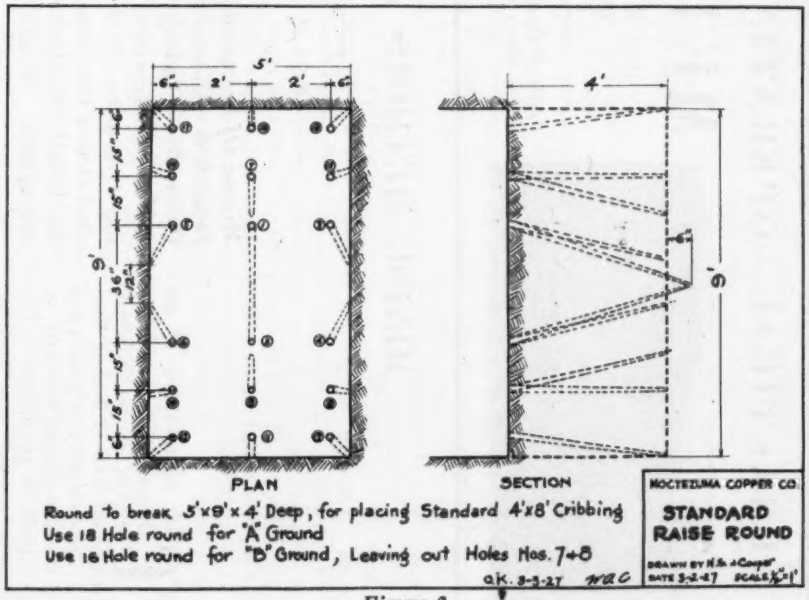

PLAN
SECTION
Round to break 5'x9'x4' Deep, for placing Standard 4'x8' Cribbing
Use 18 Hole round for "A" Ground
Use 16 Hole round for "B" Ground, Leaving out Holes Nos. 7+8
MOCTEZUMA COPPER CO.
STANDARD
RAISE ROUND

Figure 6

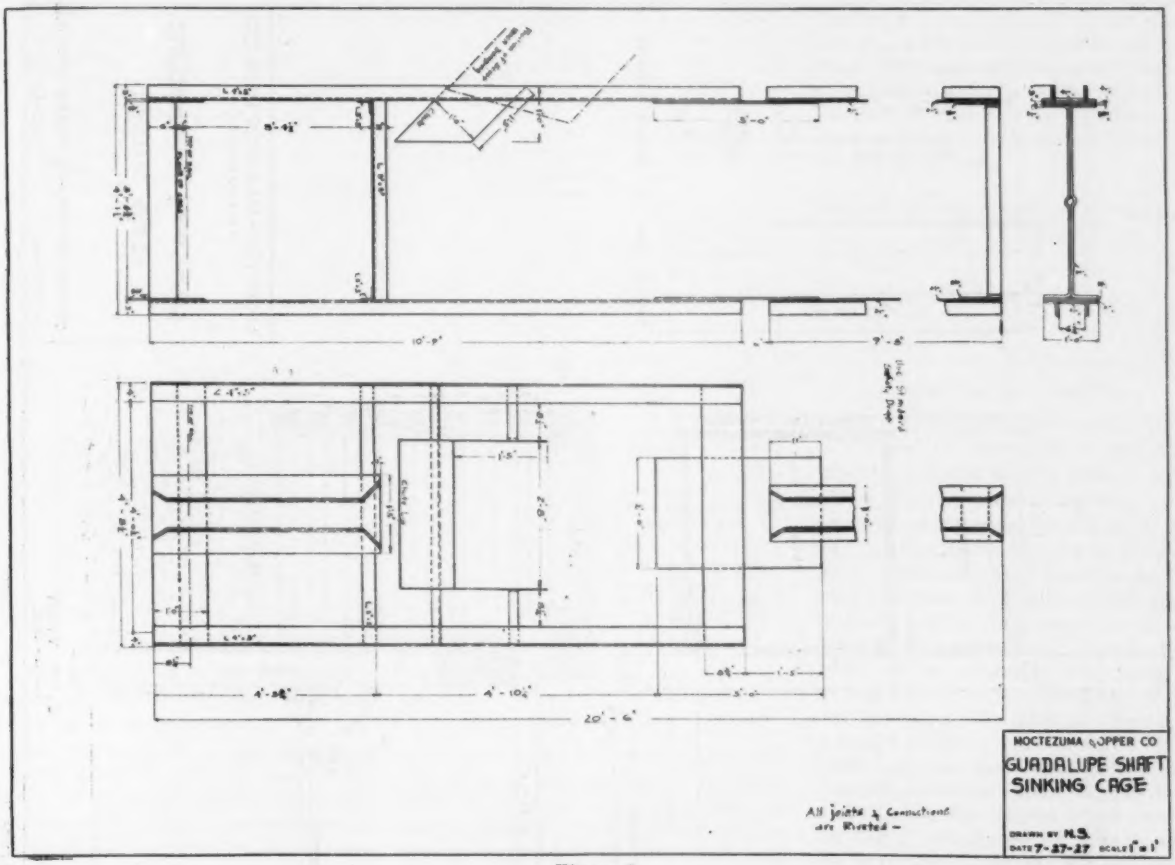


Figure 3

to be developed in the near future, will be driven at an interval of 133 1/3 ft.

Shaft and Shaft Equipment

The Pilares mine, which at present is developed down to the 1,800 level, contains four shafts, two of which—the Old Pilares and the Esperanza (see map 1,200 level, Figure 1)—are used for ventilation. Of the other two, the New Pilares shaft is used for the handling of men and supplies exclusively, while through the Guadalupe shaft is hoisted all the ore mined from the 800 to the 1,800 level. This shaft does not connect with the surface, but extends from the 500 level to the 1,900 level. The other shafts collar at the surface. The New Pilares shaft—Figure 2—consists of five compartments: A large one 6 ft. 8 in. by 9 ft. in the clear, two hoisting compartments 4 ft. 6 in. by 5 ft., a counterweight, and pipe and ladderway compartments 3 ft. 6 in. by 4 ft. 6 in. There is a decided advantage in having a large compartment because of the facility with which men and supplies can be handled. The Guadalupe shaft has a cross section outside the timbers of 6 ft. 8 in. by 16 ft. 10 in. The shaft consists of three 4 ft. 6 in. by 5 ft. compartments. The skips are of 90.9 cu. ft., 4-ton capacity.

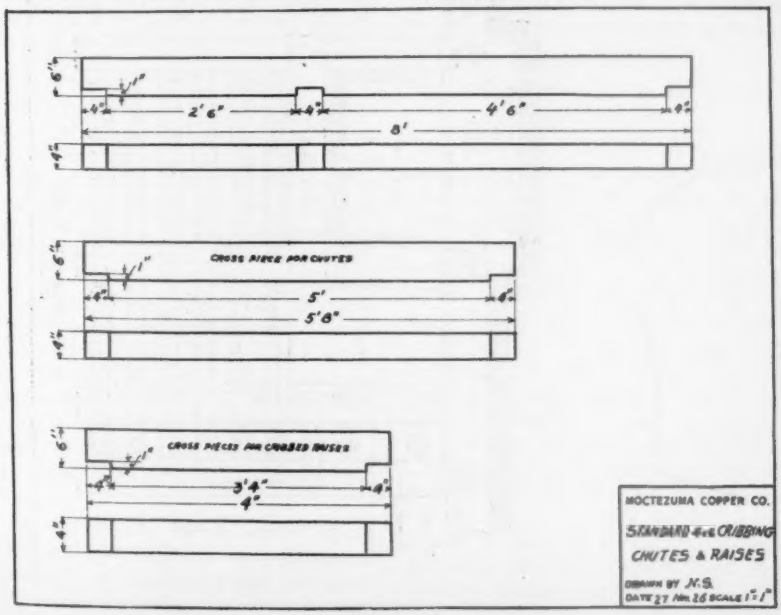


Figure 7

Shaft Sinking

During the past year the Guadalupe shaft was sunk with four compartments 4 ft. 6 in. by 5 ft. in cross section inside the timbers, to a point 2,370 ft. below the surface. A sinking cage was used instead of a sinking bucket, with satisfactory results. The sinking cage—Figure 3—was designed locally and consisted of a skeletal structure 4 ft. 1½ in. by 4 ft. 8½ in. by 20 ft. 6 in. in length. The cage was provided with 9-ft. 3-in. extension shoes and with a side chute lip, the purpose of which was to direct the broken rock into the car in the cage. The car used was of 1-ton capacity. By means of the extension shoes the cage could be lowered to the very top of the muck pile. The shaftmen shoveled into

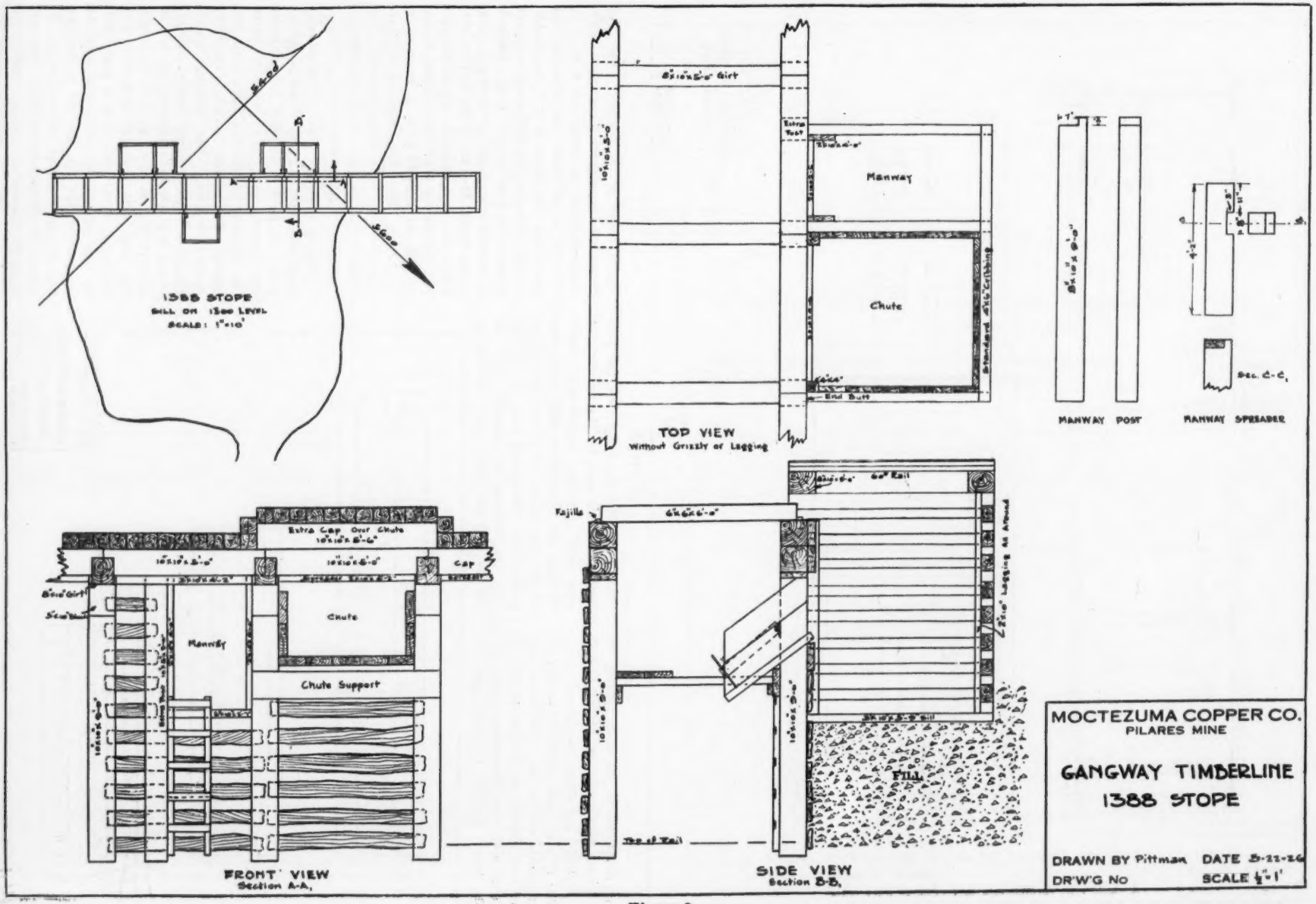
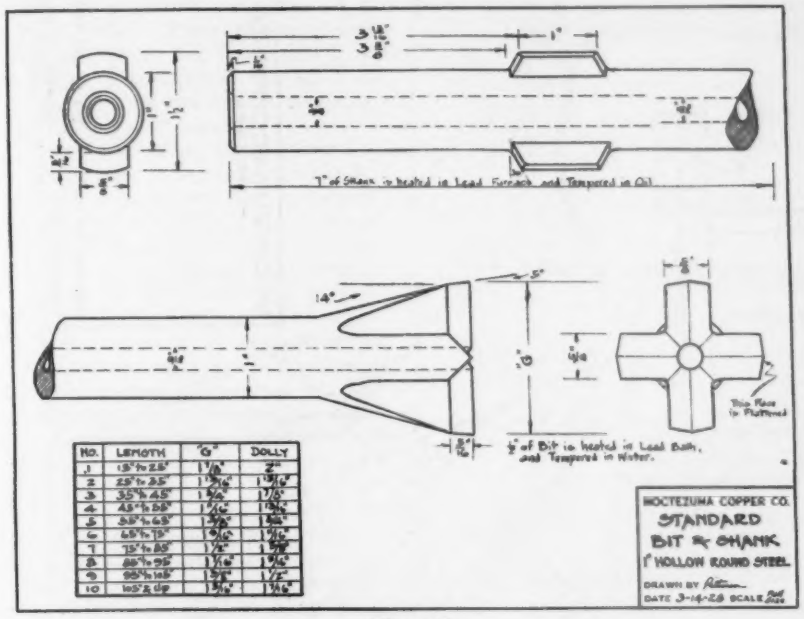

1388 STOPE
SILL ON 1300 LEVEL
SCALE: 1"=10'
Sand
Slope
TOP VIEW
Without Grizzly or Lagging
Manway
Chute
Extra Post
End Butt
MANWAY POST
MANWAY SPREADER
Sec. C-C.
FRONT VIEW
Section A-A.
Extra Cap Over Chute
Cap
Chute
Manway
Chute Support
SIDE VIEW
Section B-B.
Fill
Top of Rail
MOCTEZUMA COPPER CO.
PILARES MINE
GANGWAY TIMBERLINE
1388 STOPE
DRAWN BY Pittman DATE 5-22-26
DR'W'G No SCALE 1/4"=1'

Figure 9


1" of Shank is heated in Lead Furnace and Tempered in Oil
14°
This Face to be Flattened
½" of Bit is heated in Lead Bath, and Tempered in Water.
MONTEZUMA COPPER CO.
STANDARD
BIT & SHANK
1" HOLLOW ROUND STEEL
DRAWN BY
DATE 3-14-28 SCALE

NO.	LENGTH	"G"	DOLLY
1	18"to 25"	1⅛"	2"
2	25"to 35"	1 3/16"	1 5/16"
3	35"to 45"	1¼"	1⅜"
4	45"to 55"	1 5/16"	1 7/16"
5	55"to 65"	1⅜"	1½"
6	65"to 75"	1 7/16"	1 9/16"
7	75"to 85"	1½"	1 5/8"
8	85"to 95"	1 9/16"	1 11/16"
9	95"to 105"	1 5/8"	1¾"
10	105" & up	1 11/16"	1 13/16"

Figure 8

a tray or scoop of 20 cu. ft. capacity. The scoop, handled by a small hoist, was controlled by the shaftmen.

The cycle of mucking operations is as follows: After the cage has reached the bottom of the shaft with an empty car, the scoop containing a load is raised to the height of the chute lip of the cage. The front end of the scoop is engaged to the lip by means of chains. The scoop is then raised to a tilting position and its contents are dumped into the car in the cage. The scoop is then disengaged, and while the cage is being hoisted the tray is lowered and refilled. The scoop was constructed from specifications given by Mr. Howard R. Drullard in his article, "Shaft Sinking Today at Butte," which appeared in the *Engineering and Mining Journal*, September 26, 1927, page 357.

Drives and Raises

With the exception of the main haulage levels practically all drives are drilled 5 ft. by 7 ft. in cross section. The V-cut is the standard round adopted at the Pilares mine—Figures 4 and 5. Raises are driven 5 ft. by 9 ft. in cross section—Figure 6—and are cribbed with 4-in. by 6-in. by 4-ft. and 4-in. by 6-in. by 8-ft. cribbing—Figure 7. The cribbing is cut so as to allow a chute compartment of 3 ft. 4 in. by 4 ft. 6 in. in the clear for the broken rock, and a manway compartment of 2 ft. 6 in. by 3 ft. 4 in. in cross section. After the raise has been completed, if the ground is of a firm nature the cribbing is salvaged and reused.

All drives and raises are driven on contract. An engineer is in charge of the work of classifying the rock hardness and determining the contract price per foot.

Drill Steel

One-inch round, hollow, lugged steel—Figure 8—is used throughout the mine. Steel is sharpened at a temperature of 1,900 degrees F. In the process of tempering, the bit is heated in a lead bath to a temperature of 1,450 degrees F. and plunged into running water for a distance of one-half inch. Shanks are also heated in the lead furnace to a temperature of 1,525 degrees F., and are tempered in mineral oil for a distance of 7 in. The temperature of the lead furnace is automatically controlled by a pyrometer. The lead furnace was constructed locally under the supervision of Mr. A. Y. Smith, our master mechanic.

Stoping Methods

Conditions Affecting the Selection of Stoping Methods

In the proper selection of a stoping method two sets of factors must be taken into consideration: The general characteristics of the mineral deposit as a whole and the peculiar local conditions of the section to be mined. The most important factors determining the method of mining at the Pilares mine are as follows:

(1) Safety. (2) Size and shape of the ore body. (3) Grade of the ore. (4) Quantity of waste admixed with the ore. (5) Character of the rock surrounding the section to be mined. (6) Flexibility.

The principal methods of mining employed at the Pilares mine are horizontal cut and fill, incline cut and fill or rill, square setting, and shrinkage. Because generally the ore supports itself well, because selective mining must be practised, because the waste walls are weak, and ore bodies are of irregular size and shape, the horizontal cut and fill method of mining is most suitable. However, considerable tonnage is extracted by other methods of mining, as shown by the following table:

PERCENT OF ORE PRODUCED BY METHODS OF MINING YEAR 1927

Method	% of total
Horizontal cut and fill	58.6
Incline cut and fill or rill	15.7
Shrinkage and fill	14.4
Square set	9.8
Other methods	1.5

Horizontal Cut and Fill

In the preliminary opening of horizontal cut and fill stopes one of two practices is followed at the Pilares mine. Silling is either done on the level using gangway timberlines, or silling is carried on at an elevation of 20 ft. from the level. The grade and extent of the ore body determine the location of silling operations. After the position of an ore body has been determined by development work, silling on the level is begun by mining an 8-ft. cut to the limits of the ore or section. The back is then cut to a height of 14 ft. from the floor of the stope. At the same time that this is done, fill raises are driven, usually 50 ft. apart, along the longest dimensions of the stope. Simultaneously with the mining of the back, gangway sets 5 ft. apart are put in behind the cut—Figure 9—and fill is poured to steady the timbers. These consist of 10-in. by 10-in. by 9-ft. posts with 10-in. by 10-in. by 5-ft. caps and 8-in. by 10-in. by 5-ft. 4-in. ties. The timber is not framed. The caps are placed lengthwise with the direction of the timberline. At intervals of 30 ft. chutes with manways are raised on the fill and grizzlies are constructed using three 60-lb. rails. Where the chutes are built an extra 10-in. by 10-in. by 5-ft. 6-in. cap is placed on top of the timberline to provide increased working space for the trammer.

The timberline is covered with 6-in. by 6-in. by 6-ft. timber. The sides of the sets are lined with split lagging. The inside clearance of the sets is of 5 ft. 4 in. timber. The chute cribbing—Figure 7 consists of 4-in. by 6 in. by 5-ft. 8-in. and 4-in. by 6-in. by 8-ft. timber so cut as to provide for a chute compartment of 4 ft. 6 in. by 5 ft. and a manway compartment 2 ft. 6 in. by 5 ft. in cross section. The chute compartment is lined with 2-in. by 10-in. by 8-ft. lagging to prevent wear and tear of the cribbing by the ore. After the chutes have been raised, the final filling of the stope is completed. Mining of the ore is resumed, beginning at the weakest end of the stope. An 8-ft. cut is taken with a mounted machine. With the completion of the

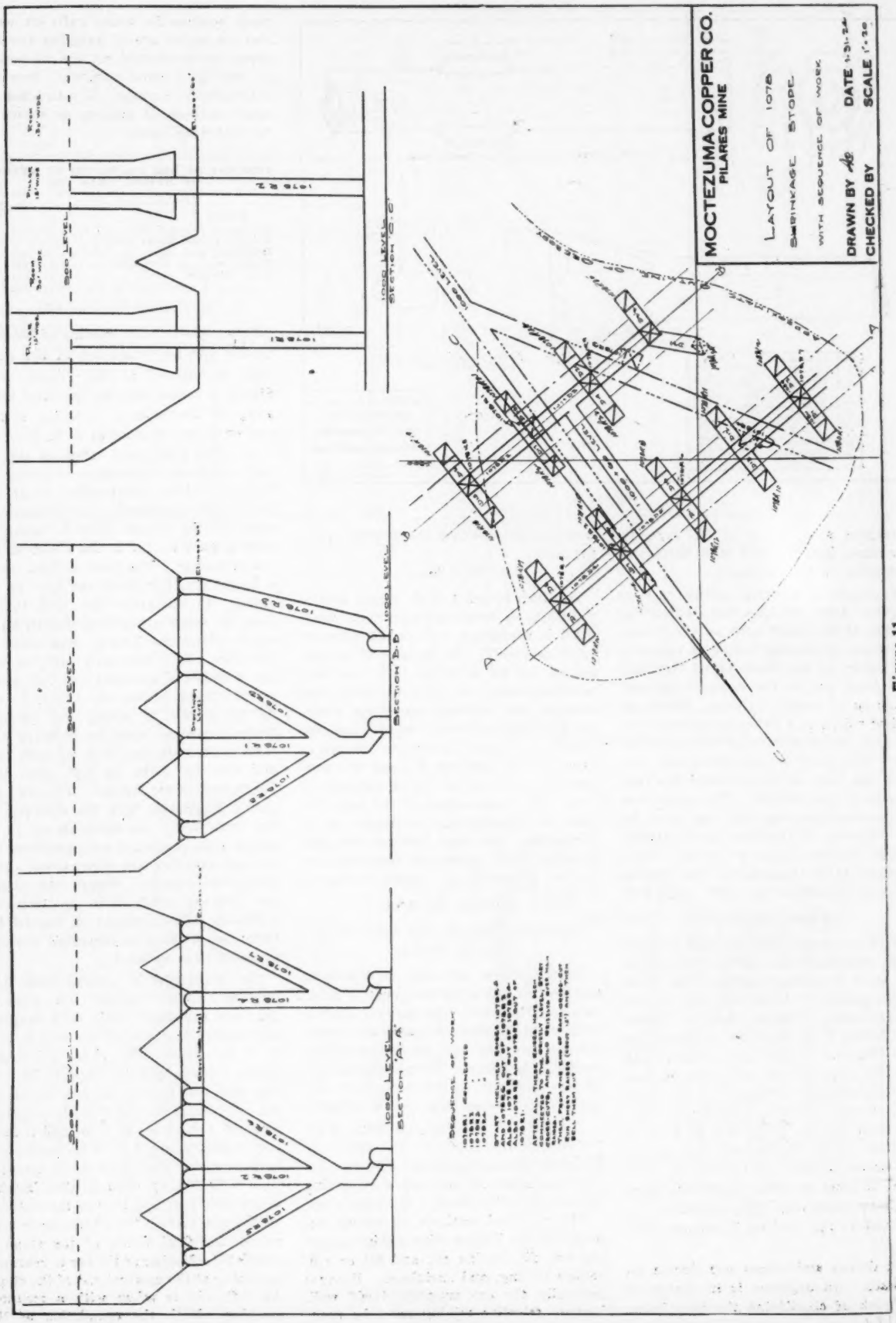

MOCTEZUMA COPPER CO.
PILARES MINE
LAYOUT OF 1078
SHRINKAGE STOPE
WITH SEQUENCE OF WORK
DRAWN BY
DATE 1-31-24
CHECKED BY
SCALE 1"=20'
SEQUENCE OF WORK
SECTION A-A'
SECTION B-B'
SECTION C-C'
1088 LEVEL
905 LEVEL

Figure 11

preliminary work each successive cut is of 8 ft. Waste filling follows closely behind the cut so that production from the section is continuous. The filling of the stope is accelerated by spreading waste with cement buggies.

Whenever conditions permit, there is a decided economy in opening stopes 20 ft. above the level, in that the expense of the gangway timberline and its repair work is eliminated. A raise is driven from level to level through the ore body. At a point 20 ft. above the level an 8-ft. sill is cut to the limits of the section. While this work is being carried on chutes with manways, at 25-ft. intervals from one another, are driven into the stope to facilitate the handling of broken ore. At the same time waste fill raises are driven every 50 ft. from the stope to the level above.

When silling has been completed the back of the stope is cut to a height of 12 ft. Behind the cut cribbed chutes are raised 8 ft. and waste fill spread to within 4 ft. of the back. When the stope is completely filled an 8-ft. cut is taken from the back. Each successive cut is of 8 ft. On approaching the level, if the stope lies under a filled section the method of mining is changed to either brow caving or square setting.

Sorting of waste is done in all horizontal cut and fill stopes.

Rill

The preliminary work of preparing rill stopes—Figure 10—is the same as for horizontal cut and fill. The sill is cut to the limits of the ore body, starting at a point 20 ft. above the level. At the lower end of the stope an ore chute is connected into the section 10 ft. from the waste wall. The driving of the chute at this point provides for a 10-ft. sorting space the full width of the stope, where waste picked out from the ore may be piled. An auxiliary chute is driven in the center of the stope to expedite the handling of broken ore.

On the opposite end of the lowest ore chute a waste raise is driven to the level above. On completing this raise, fill is poured into the stope close to the back and an incline cut is taken 6 ft. in thickness. This cut being completed, a second fill is made, followed in turn by another cut; this procedure continuing until the slope, the full length of the section, is completed. The last fill is poured to within 4 ft. of the back of the stope.

When the preliminary work is finished, the back at the lowest end of the stope is cut horizontally to a height of 10 ft. to provide sorting space and working room for the men on the grizzlies. Cutting of the back from top to bottom is then begun. An 8-ft. cut off the back is taken. After the cut is completed the chutes are raised 8 ft. The chute at the bottom of the stope is doubled in size to increase the grizzly area. Waste is poured into the stope to a point 4 ft. from the back, and the cycle of mining begun over again. No flooring is used, precautions being taken to wet the fill before mining the ore, and on completion of the cut to scrape the fine ore remaining in the stope down to the waste.

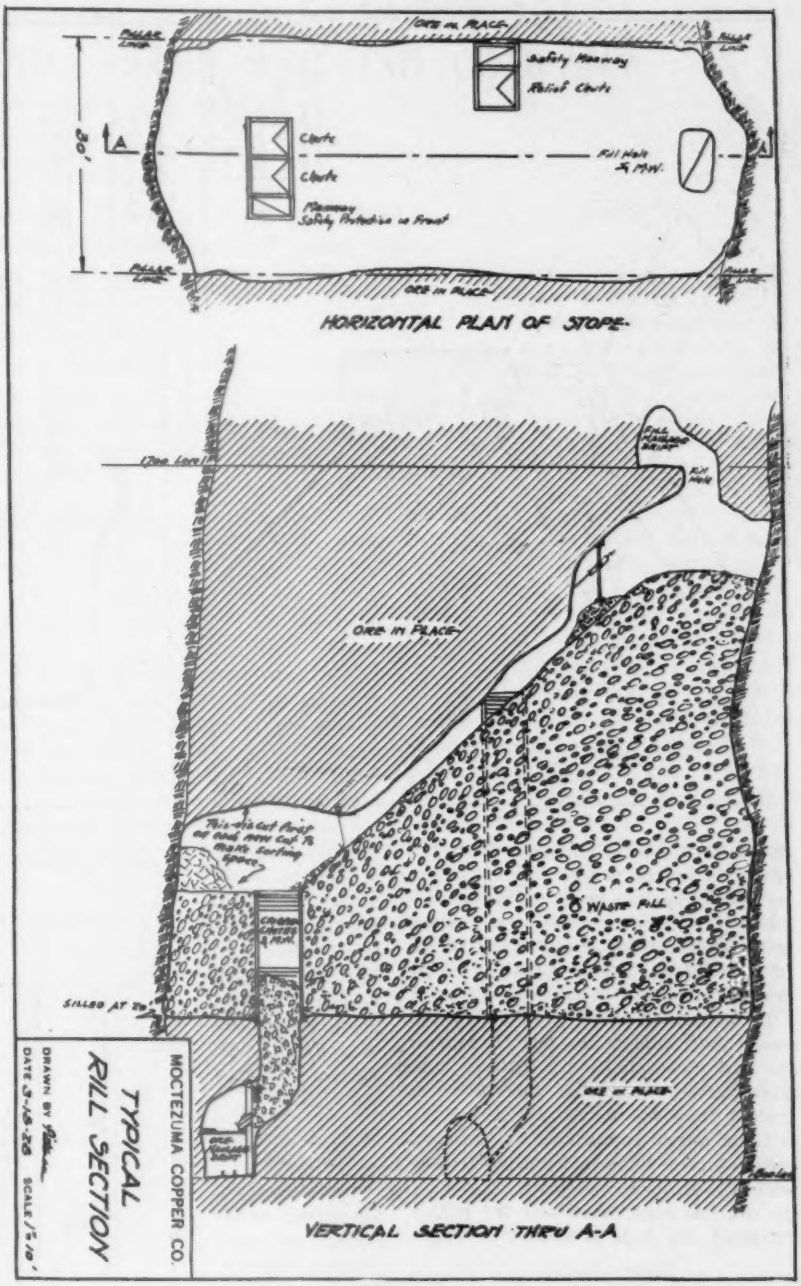


Figure 10

Shrinkage

Occasionally ore bodies are encountered, especially near the center of the oval, which are amenable to shrinkage methods of mining. The general plan in opening a shrinkage stope is to drive one or more raises through the ore bodies—Figure 11. From these raises, on the bottom of the ore a sill 8 ft. in height is cut to the limits of the stope. While silling is being done, sublevels, or grizzly levels—marked shovelway level in Figure 11—are driven 50 ft. apart and 20 ft. below the bottom of the stope. From the grizzly level at 25-ft. intervals short incline raises, or draw raises, are driven to connect with the stope. The raises are widened to facilitate drawing the ore. The grizzlies, which are located at 25-ft. intervals on the sublevels, dis-

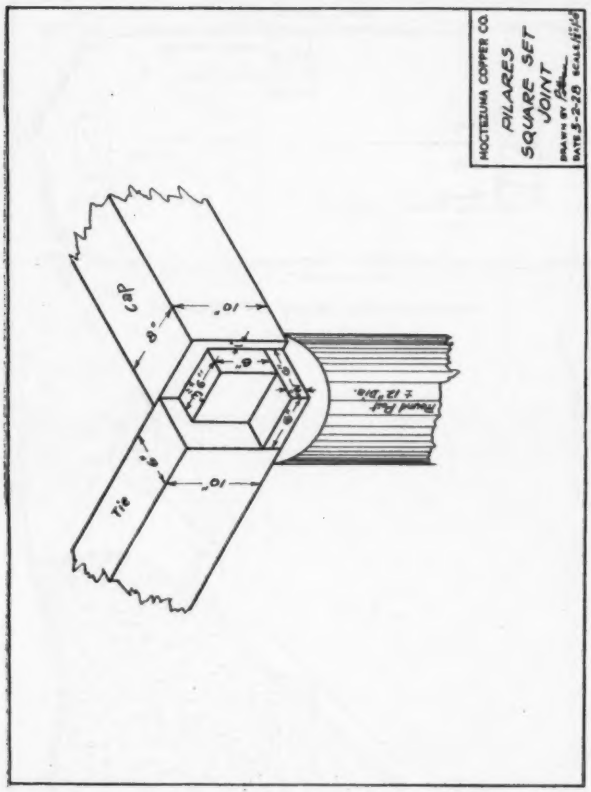


Figure 12

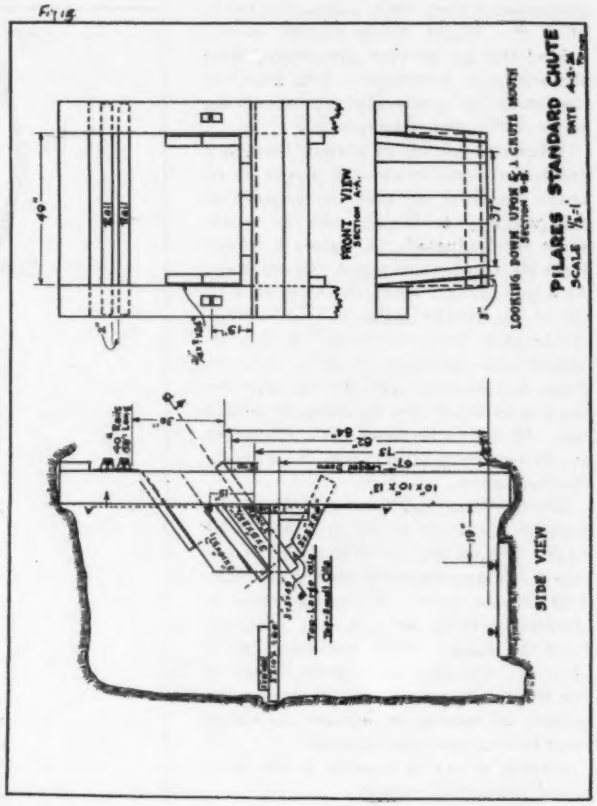


Figure 13

charge into main ore passes through a system of branch raises. The ore passes lead to the haulage level. After the preliminary work is completed, ore is mined in the stope by taking a 12 to 14 ft. cut from the back. The overbreak or excess ore is drawn out on the haulage level.

If the section is of large dimensions small 15-ft. pillars are left to support the roof. The pillars are undercut and mined after all the ore has been extracted from the stope. While the ore is being mined precautions are taken to break up large slabs which cause trouble while the ore is being drawn. After all the ore has been taken and the pillars extracted, the stope is filled with waste.

Square Setting

Most of the tonnage extracted by square sets comes from mining pillars left between old stopes. Occasionally an ore body is opened which requires timber for its support. Square setting is also used in cut and fill stopes when these approach the bottom of a mined-out section. When starting a square set section on a level, posts 9 ft. 2 in. long are used. These posts are either 10 in. by 10 in. in cross section or 12 in. round. After the sill has been mined, the bottom of the section is floored with 2-in. lagging before the stope is filled.

The standard set—Figure 12—consists of a round post 7 ft. 6 in. in length and 12 in. in diameter, an 8-in. by 10-in. by 5-ft. cap, and a 6-in. by 10-in. by 4-ft. 6-in. girt. Square set sections vary from two to four sets in width and from five to twelve sets in length. All square set stopes are filled.

Other Methods of Stoping

This includes top-slicing, brow-caving, and combination methods. At present a very small amount of ore is mined by other methods of mining.

WASTE FILLING

Practically all the waste rock for the filling of stopes is quarried on the surface over the mine workings. The waste, after being broken up on grizzlies in cham-

(*Con. on p.* 354)

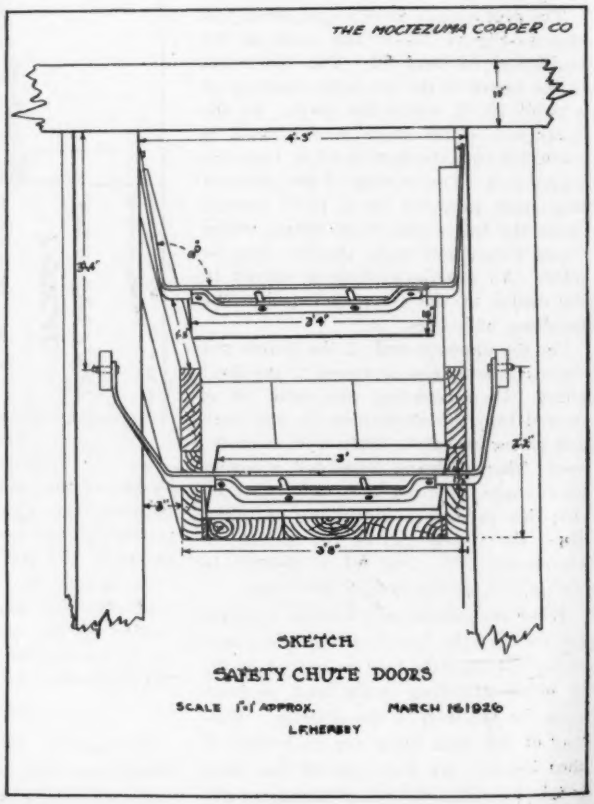


Figure 14

VENTILATION PROBLEMS *at the* BUTTE MINES *of the* ANACONDA COPPER MINING COMPANY

By A. S. RICHARDSON *

Increasingly Greater Depths At Which Mines Are Being Operated Presents Chief Ventilation Problem—How Air Has Been Coursed To Greater Depth, And Problems Incident Thereto Outlined—Reversible Surface Fans Circulate 3,000,000 Cu. Ft. Of Air Per Minute—Twenty-Six Underground Booster Fans Circulate 1,500,000 Cu. Ft. Per Minute, Driven By Motors Of 1,850 Hp.

VENTILATION problems at the Butte mines of the Anaconda Copper Mining Co. have, for the past few years, been related mainly to the increasingly greater depths at which the mines are now being operated. Considerably higher temperatures have been encountered in the newly opened levels and in certain places the water flowing from the veins has reached a temperature of 118 degrees F. To obtain the desired flow of air, extensions have been made to the main air courses and booster-fan equipment has been installed to provide the additional ventilation pressure required to course the air to the lower horizons. In carrying out these plans a number of details have had to be worked out by members of the operating force and the features to be described are the result of cooperative effort.

In 1918 and the years immediately following, large expenditures were made to smooth-surface existing upcast shafts so as to reduce the frictional resistance or to increase their air-carrying capacity. At the same time larger, reversible fans were installed at the surface to handle the increased flow, and the volume of air circulated through the mines was approximately doubled.

Since all of the old air shafts had originally been intended for use as hoisting shafts, they were designed solely for suitability to that purpose. To their present service as air courses they are not well adapted, because the multiple rectangular compartment shaft presents a large friction surface that the air must flow over, or one which is proportional to the total perimeter inside the compartments. The ratio of friction surface to clear area open to the flow of air is therefore, very high. To overcome this disadvantage an octagonal-shaped opening which has a low ratio of friction surface to clear area has been substituted, and the old type of shaft has been abandoned in providing extensions to these air courses.

With clear area, power consumption, and coefficient of frictional resistance of surface, equal in both cases, the octagonal openings will carry about 40 percent more air than the multiple-compartment shaft of the size in common use. For an equal volume of air the comparison of clear area required in the two cases is not quite so favorable. This is due to the fact that reducing the area increases the velocity of air movement, and as the frictional resistance is proportional to the square of the velocity a relatively slight decrease in area greatly increases the resistance of the section. However, on account of the area taken up by centers and spreaders in the ordinary rectangular-compartment shaft, the saving in actual excavation for the octagonal opening will again approximate 40 percent.

Comparing the resistance to the flow of air offered by the octagonal smooth-surfaced shaft with that of the circular concrete-lined shaft, which has an ideally low resistance, the difference is so small as to be practically negligible. Timber may be readily adapted to the octagonal form, and when set skin-to-skin will form a continuous lining or support which has great structural strength and is very much superior in this respect to the ordinary square-set framing. The excavating of ground and timbering are easily carried out by raising, at a low cost. Character of ground through which the air courses will have to be maintained, together with cost, were the governing considerations that impelled the selection of timber support for the air courses of this type that have

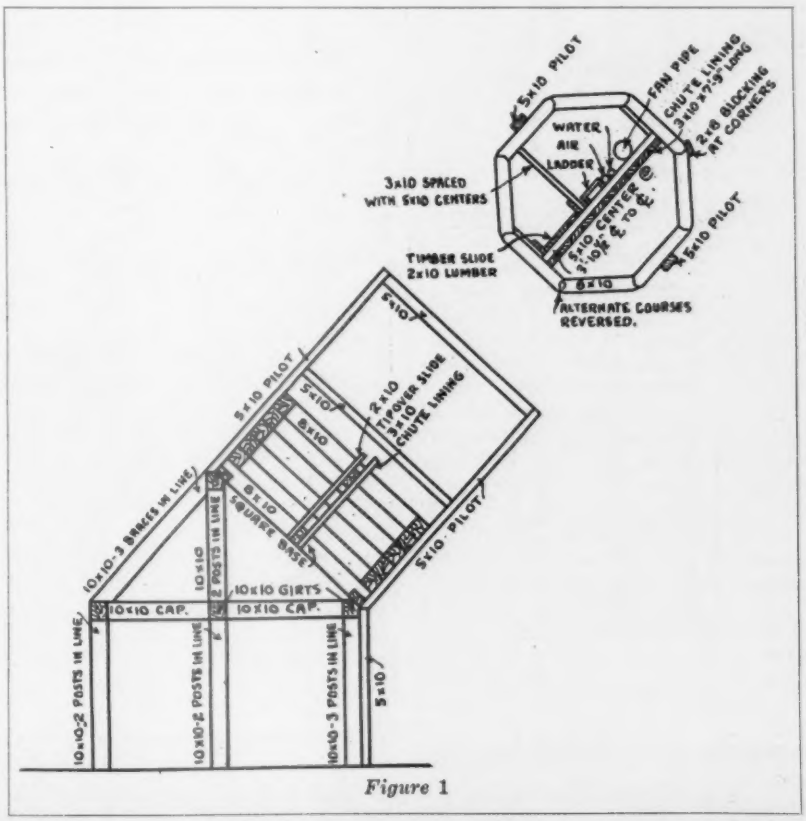


Figure 1

* Ventilation Engineer, Anaconda Copper Mining Co.

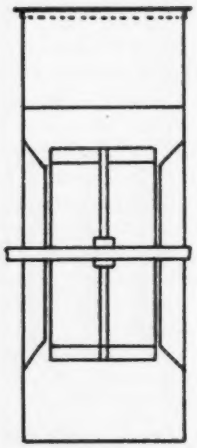
so far been completed. In other cases, and under different conditions, a circular section and monolithic concrete lining may possibly be used.

Although the location of the old air shafts was in most instances satisfactory for the ventilation of the upper levels, they are not in some cases so well situated for the ventilation of the lower levels because the dip of the veins has carried the ore bodies to some distance from the vertically projected positions of the shafts. In such cases it would, therefore, be necessary to open and maintain long cross-cuts to carry air to the shafts if their downward extensions were to be carried in a vertical line. To obviate this, the extension to the shaft will, where necessary, be carried downward at some suitable angle to the vertical approximately parallel to the dip of the veins, thus avoiding unnecesasry expense by shortening the length of air courses and also reducing resistance to the flow of air.

Where the shafts are already at some distance from the veins, a large-sized cross-cut will be carried from the bottom of the shaft to a point near the vein, and the downward extension of the air course made by raising octagonal openings in a line parallel to the dip.

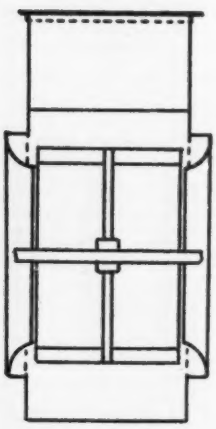
Details of framing main timbers, for an inclined octagonal raise are illustrated in Figure 1. It may be noted that the members of each ring of timbers are so placed that the joint planes between individual pieces of one ring are not below the joint planes of the ring above. This is effected by reversing ends of all members of alternate rings. A preservative has been applied to protect the timber from rot, and minimum of repair expense is expected.

Another type of shaft opening that may be of interest as an illustration of methods of reducing the resistance of main air courses is given in Figures 2a and b. In this case the shaft which extended only from the surface to the 400 level was originally used for operating purposes, and had two compartments. Later it was converted into an air shaft, two more compartments were added, and the whole shaft was smooth-surfaced. Finally the timbering in the shaft, and also in connecting air raises below, became so rotted that the air course could no longer be relied upon. Below the 400 level the resistance of the raises and cross-cuts constituting the air course were extremely high, making difficult the satisfactory ventilation of the mine. A careful inspection and analysis made it evident that it would be more economical to open a new octagonal air course from the 400 level downward rather than to undertake expensive repairs and alterations.



—Fan before Remodeling—

Figure 3(a)



—Fan after Remodeling—

Figure 3(b)

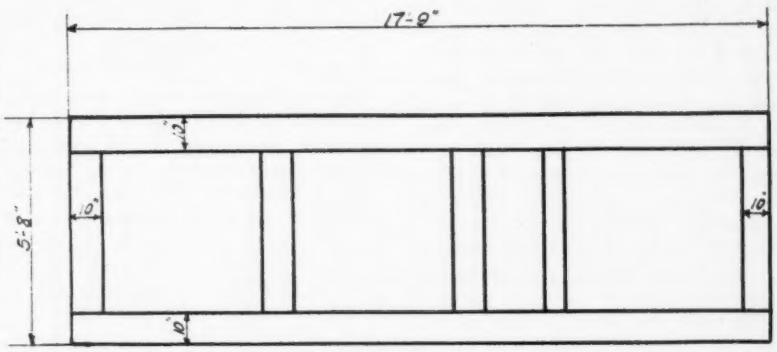


Figure 2(a) — Old Air Shaft before remodeling —

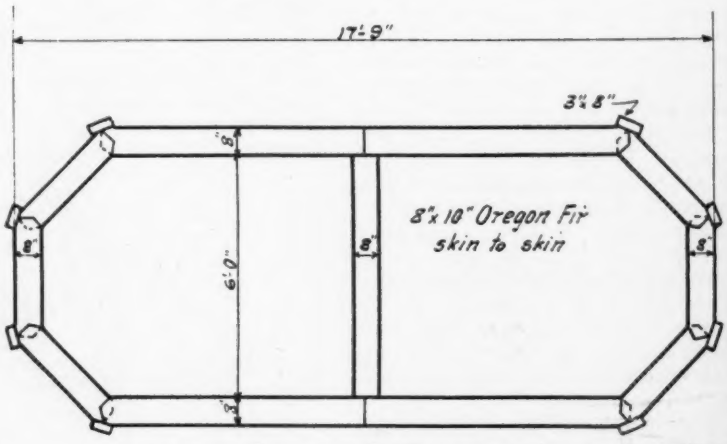


Figure 2(b) — Air Shaft after remodeling —

The problem which then arose was to remodel the old shaft from the surface to the 400 level, so that it would not offer an unduly high resistance to the flow of air and thus throttle the ventilation of the mine. Since retimbering was necessary, the shaft support might be entirely changed, but the shape of the opening must conform somewhat closely to that of the existing excavation. The opening finally decided upon consists of two halves symmetrical about a central spreader with arched ends, containing elements of an octagon. Dimensions of old and new shafts are given in the illustrations.

The air-carrying characteristics of the two shafts is indicated to some extent by a comparison of the previously mentioned ratio of frictional perimeter to clear area open to the flow of air. In the old shaft the total perimeter inside all compartments was 60 lin. ft., while the clear area was only 56 sq. ft., thus giving a ratio of friction perimeter to clear area of 1.07. In the new shaft the friction perimeter is 51 lin. ft., while the clear area is 87.7 sq. ft., or a ratio of 0.58. In a more practical sense it may be said that the air-carrying capacity of the shaft was approximately doubled.

While extension of upcast air courses to greater depths is being carried out at a rate consistent with the increasing depth of mine development, and in such a manner as to offer as nearly as possible a minimum resistance to the flow of air, the other main air courses are not being left out of consideration. Most important in this connection is improvement in the air-carrying capacity of the inlets, or main hoisting shafts.

With the recent installation of a new electric hoist at the Mt. Con mine, it became necessary to retimber the hoisting shaft. Opportunity was then afforded to excavate an additional shaft compartment that might be used solely to carry air into the mine. This was done, and the volume of air flowing through the shaft was thus increased by approximately 50 percent. Since completion of the work the average temperature of all working places has been reduced more than 4 degrees, so that substantial benefit has already been derived from the expenditure incurred. Later it is planned to smooth-surface the air compartment with an air-tight lining and to install a pressure fan at the surface so as to obtain a maximum velocity or volume of air flow.

Practically no changes have been made in respect to surface fans. As has been stated, the ventilation problem has been mainly to course the air flow to greater depth, and no great increase in flow has been made. The reversible equipment installed about 10 years ago is, therefore, operating substantially under the conditions for which it was designed, and is giving satisfactory service.

In the case where changes were made to the upcast air courses, as previously described, the volume of air passing through the surface fan has been very greatly increased. Specifications for the fan called for the delivery of 125,000 cu. ft. per minute from the mine against a frictional resistance equivalent to 6.5 in. of water. As a result of the opening of the new octagonal air course and the addition of a new inlet air course the resistance to the flow of air offered by the mine workings has so decreased that a flow of 210,000 cu. ft. has been obtained with a frictional resistance equivalent to only 4.1 in. of water.

Power is furnished by a 300-hp. motor, but the mechanical efficiency of the fan has under these conditions of operation decreased to approximately 45 percent, so that a considerable part of the benefit that should have been derived from reducing the resistance of the air courses has been dissipated in this lowering of fan efficiency, and the motor was overloaded.

Consideration was therefore given to various measures for improving the efficiency of the mechanical equipment, including the installation of an additional fan to operate in parallel and relieve the main fan of excess load. The plan finally adopted was, however, prompted by certain changes that have more recently been made in details of fan design, notably the inlets. As installed on the original fan these were frustrums of cones and placed within the fan housing, necessitating considerable clearance between the side rims of the wheel and the fan housing. Details are illustrated in Figure 3a. It was proposed to the fan manufacturing company that streamline inlets should be substituted and a wider wheel used according to the plan illustrated in Figure 3b. To the probable success of such an arrangement they did not at first agree, stating that although the stream-line inlets would help, they did not anticipate much benefit from the use of a wider wheel.. As a result of further investigation this opinion was later reversed, and it was agreed that the mechanical efficiency might be raised from 45 to better than 65 percent. A wider wheel and special inlets were, therefore, purchased in accordance with the original proposals and will be installed in the near future. Power requirements vary in a ratio somewhat greater than the cube of the volume, but with the use of the same 300-hp. motor it is estimated that the flow will be increased approximately by an additional 25,000 cu. ft. per minute. Later the mine resistance may again be decreased, and it is expected that a further increase in flow will be efficiently maintained by the fan.

As previously intimated, a great increase has been made in the number of booster fans used to supplement the ventilation pressure developed by the main surface fans, and to course the air to the lower levels or other sections of the mine where most needed. In 1920 this service required the use of 12 fans circulating 750,000 cu. ft. per minute and driven by motors of 900 total nominal horsepower. The equipment in use varies somewhat from time to time, but at present there are in use 26 fans circulating approximately 1,500,000 cu. ft. per minute and driven by motors of 1,850 nominal horsepower.

Surface fans circulate approximately 3,000,000 cu. ft. per minute, which might lead to the conclusion that only 50 percent of the circulation passes through the underground booster fans. However, a considerable number of mines are successfully ventilating without booster equipment, so that the percentage of circulation passing through the boosters at the mines where they are in use is considerably higher.

To a large extent the fan equipment for this service has been derived from old surface installations that became available when the larger reversible fans were installed to take care of the increased flow resulting from work done to reduce mine resistance. In a number of cases, however, this equipment was not suitable for the service desired, and a number of booster fans have been purchased at different times.

One feature of booster-fan service that causes considerable trouble is the fact that when a ventilation door is left open a short circuit is created in the ventilation system. With centrifugal fans of the type in which blades are tipped forward, such a condition immediately results in an overload on the motor that causes trouble with electrical equipment and belt drives. To eliminate difficulties of this character the centrifugal fans that have been purchased during the past few years have been of the more recently developed type in which the blades are tipped backward. A very desirable characteristic of this fan is that it operates with nearly constant power consumption under all conditions and, therefore, does not overload the motor when a short circuit occurs. They may also be designed to run at speeds suitable for direct connection to alternating-current motors, and thus eliminate the more or less troublesome and expensive belts. To prevent corrosion, copper-bearing steel plates are specified in the construction of these fans.

Auxiliary ventilation of dead ends, and other places where the regular ventila-

tion system does not provide an adequate circulation, is effected by means of canvas tubing and small blowers. This system has been in use for a long time and is well known. The only noteworthy developments have been the general tendency toward the use of somewhat larger-sized tubing and a decided improvement in design of blowers.

Formerly the general practice was to use 8-in. tubing for ventilation in driving raises mainly because it was not considered practicable to carry larger-sized tubing in the manway. More recent practice has indicated that better results may be obtained by the use of 12-in. tubing in these places, and the 8-in. tubing now has only an inconsiderable use.

In all lines a certain amount of leakage from cuts and breaks in the material seems to be unavoidable. Where the air has to be carried for long distances it has, therefore, been found advisable to carry as large a sized pipe as possible for some distance from the blower in order that a large initial volume may compensate to some extent for leakage losses. Tubing up to 24 in. in diameter is often used in such service or to deliver air to splits of smaller-sized tubing for the ventilation of two or more places. In one case where three levels off the bottom of a shaft were to be developed, 36-in. tubing was carried down one of the shaft compartments and splits of smaller-sized tubing were taken from it to the working faces. Special fan equipment was, of course, required.

Blower equipment formerly used in conjunction with tubing for mine ventilation was of standardized design and not well adapted to such service. As an example, the blowers formerly used on 16-in. tubing were direct-connected to 20-hp. 1,140-r.p.m. motors, and in underground service developed a maximum pressure of about 4½ inches. At that pressure the ordinary 16-in. line will carry only about 3,000 cu. ft. of air, so that although the blower would deliver several times that volume the pressure was insufficient to force it through the tubing. The size of the equipment was such that it had to be sectionalized whenever moved on the cages from one part of the mine to another, and power consumption was, of course, excessive.

The equipment last purchased for this service was developed cooperatively with the fan manufacturing company. It has a rated delivery of 3,000 cu. ft. per minute against a resistance of 6.5 in. of water, and is driven direct-connected to a 5-hp. 3,460-r.p.m. motor. Size is such that it may be placed on cages without being sectionalized, and it weighs about 450 lbs. complete with motor, compared with a weight of 1,150 lbs. for the unit it replaces.

Under ordinary operating conditions about 300 blowers are in use, and the annual requirements of canvas tubing approximates 150,000 lin. ft.

MINING METHODS AT PILARES

(*Continued from page* 350)

bers situated just below the glory holes, is delivered underground through a system of raises which reaches the lowest levels.

STOPING DATA—YEAR 1927

Stoping method	Pounds powder per ton	Ft. of timber	Tons per man shift
Horizontal cut and fill..	.421	2.509	4.261
Rill	.413	1.587	5.248
Shrinkage	.154	1.076	12.407
Square setting	.290	17.461	3.489

Chutes

In the standard chute used at the Pilares mine—Figures 13 and 14—the quantity of 10-in. by 10-in. timber has been reduced to a minimum. The main parts of the chute consist of two 10-in. by 10-in. by 12-ft. posts set 49 in. apart, a chute lip built of 3-in. by 10-in. timber tapering from 43 in. at the back to 37 in. at the discharge end, a working platform 67 in. from the top of the rails, and two iron chute doors, a lower and an upper or cut-off door, 3 ft. and 3 ft. 4 in., respectively. The wear on the upper back side of the chute is taken up by two 40-lb. rails 68 in. long, held in place by two iron clamps. This type of chute is easily and speedily constructed, does not cost excessively in material, and gives excellent service.

Tramming and Hoisting

Both hand and electric tramming is done underground. For the former 22 cu. ft. end dump cars are used. For motor haulage 22 and 33 cu. ft. rocker side dump cars are used. The bulk of the ore and waste is handled by electric locomotives, both trolley and storage battery. The standard underground track gauge is 20 in.

All the ore mined is handled on the 700 level through the Porvenir Haulage Tunnel. The ore mined from the 800 to the 1,800 levels is trammed to a main dump, the 89 storage chute, located near the center of the mine, from where it reaches the 1,550-ft. and 1,850-ft. Guadalupe shaft pockets. At present, the ore is hoisted from these two pockets into the 500 level storage bins, from which it is loaded, on the 700 level, into cars of 25-ton capacity running on a 36-in. gauge.

The ore above the 700 level is trammed into main ore dumps which connect with chutes situated in the Porvenir Tunnel. Electric trains, consisting of six cars, haul the ore from the Porvenir Tunnel to the Porvenir Yard, from where trains of 12 cars, drawn by steam locomotives, transport the ore to the Nacozari Concentrator.

Contract System

Practically all the underground work is done on a contract basis. The contractor is responsible for every phase of the work. Underground contracts are segregated into three general classes: Stoping, development, and miscellaneous contracts. All the contracts are given by the division foreman, and are checked and approved by the general mine foreman.

Safety

Every possible safety precaution is taken underground, in an effort to reduce accidents to a minimum. Stopes are mined with mounted machines to decrease the shattering of the back with its corresponding hazard. In horizontal cut and fill stopes shovelers work behind the machines. An extra light rail is placed across grizzlies over the chutes to diminish the size of the openings between rails. Raises are timbered with 4-in. by 6-in. cribbing while being driven. Ore and waste dumps are protected with light swinging doors to prevent men from falling into them.

All underground men are compelled to wear hard-boiled hats. They are also equipped with screen goggles to be used when breaking boulders, collaring holes, moiling, and cleaning holes with the blow pipe. We have found that the safety-first man is the most efficient worker, and that safety pays.

Acknowledgments

I wish to thank the Pilares engineering staff for their help in supplying and checking the data submitted in this paper.

PROPAGATION OF FLAME IN COMPLEX GAS MIXTURES

Data obtained in a study of the propagation of flame in complex mixtures, conducted by the Bureau of Mines, have made it possible to predict the inflammability of any mixture of hydrogen, carbon monoxide, and methane with varying proportions of oxygen, carbon dioxide and nitrogen from a simple analysis of the mixture. Results are of considerable value in connection with mine fires and in many industrial operations where inflammable mixtures may be present. The inflammable limits of the complex mixture are calculated from the data obtained for the individual gases. Comparison between calculated and observed values has been made on a series of synthetic gas mixtures including typical blast-furnace gas, automobile-exhaust gas, gases from detonation of explosives in coal mines, gases after coal-mine explosions, and mine-fire gases.

Southwest Copper Companies to Refine Own Copper

An agreement has been reached whereby the Phelps Dodge Corporation, Calumet and Arizona Mining Company and the New Cornelia Copper Company will acquire an interest in the Nichols Copper Company. This will permit the producing companies to refine their own copper. The metal will be refined at the present refinery of the Nichols Copper Company at Laurel Hill, N. Y., and at another refinery to be built in the Southwest. The site for the new plant has not yet been definitely selected.

Copper produced will be marketed through the Phelps Dodge Selling Agency.

Eagle Picher Lead Company Equips Arizona Property

Montana Mines Operations, a subsidiary of the Eagle Picher Lead Company, is completing a 200-ton flotation mill at its property at Arivaca, Ariz. It is expected that the mill will be placed in operation early in May.

The vertical shaft has been sunk to a depth of 400 feet and a new station cut on the 400-foot level. Approximately 150 men are now employed on development and construction work. The ore developed contains lead with minor amounts of silver, zinc and copper. Lead, zinc and copper concentrates will be produced.

Tybo Mill to be in Operation in Fall

The projected mill on the property recently acquired by the Treadwell Yukon Company at Tybo, Nev., will probably be placed in operation about October 1. The mill will have a daily capacity of 200 tons.

The company has expended approximately $400,000 in mine development and a considerable tonnage of lead-silver ore has been blocked out largely in the older area of the mine. Ore from development work has yielded a return of $22.47 per ton. Development of new ground at greater depth is yielding satisfactory results. When the mill goes into operation, the Tybo will become one of the important metal producers of Nevada.

Colorado Mining Men Propose Modern Reduction Plant at Denver

Jesse F. McDonald, president of the Colorado Metal Mining Association and director of the Western Division of the American Mining Congress, has appointed a committee to report on the feasibility of building a modern reduction plant for the treatment of low grade ores at Denver, Colo., and to interest capital in financing such a plant. The proposal is for a custom plant to receive ores from the various districts of the state.

The committee members are Jack Joyce, state mining commissioner, chairman; R. M. Henderson, E. A. Monahan, R. J. Walter, J. R. Wolfe, and F. L. Wolfe.

ARIZONA CHAPTER OF AMERICAN MINING CONGRESS TO MEET IN AJO

The spring meeting of the Arizona Chapter of the American Mining Congress will be held at Ajo, Arizona, on April 30 and May 1. The New Cornelia Copper Company will act as host to the visitors.

A series of papers covering the operating practice of the New Cornelia Copper Company will be presented and visitors will be given every opportunity to see the various plants in operation.

Old Colony Mines, Ltd., Acquires Arizona Properties

The Old Colony Mines, Ltd., of Toronto, Canada, has taken over the properties of the Comstock Silver Mining Company and the Arizona Premier Mines Company in the Stockton Hill district near Kingman, Ariz. This involves approximately 60 claims. Both of these properties have had some production. The Old Colony Mines, of which P. W. Wood is president, is reported to be financed for the active development of the Stockton Hill properties. E. E. Campbell will be in charge of the operation of these properties.

William D. King Killed in Airplane Crash

William D. King, of Douglas, Ariz., was killed recently in an airplane crash at Toluca, Mexico. Mr. King, accompanied by Sterling Rohlfs, manager of the Bartlett ranch in northern Mexico, and Wallace Springer, of Cimarron, N. Mex., were on their way to Mexico City. Sterling Rohlfs, an expert pilot, was at the controls. The plane fell from a height of a thousand feet when caught by a sudden gust of wind.

Mr. King was counsel for several American mining companies operating in Mexico. He was exceptionally well versed in Mexican law and also a thorough student of the literature and history of Mexico. His engaging personality made him many friends among Americans and Mexicans alike. He came to the Southwest 20 years ago as secretary to James Douglas and was later in the employ of the Moctezuma Copper Company.

Mr. King is survived by a widow and three children residing at Douglas, Ariz.

Alaska Juneau Acquires Power Plants

The Alaska Juneau Gold Mining Company recently purchased the physical assets of the Alaska Mining Company, the Alaska Mexican Company and the Alaska Treadwell, consisting largely of power plants serving the Alaska Juneau mines. These plants were acquired by the payment of 46,000 shares of treasury stock. It is estimated that this will effect a saving for the Alaska Juneau of approximately $75,000 per year in power cost.

Net profits of the Alaska Juneau Gold Mining Company for the first quarter of the year were $300,000. This compares with a substantial deficit for the first quarter of last year.

Dr. Francis A. Thomson Heads Montana School of Mines

Dr. Francis A. Thomson was appointed president of the Montana School of Mines at a formal meeting of the regents of that institution in Helena. The position was offered to Dr. Thomson several weeks ago, and after conferring with a few friends among Northwest mining men he decided to accept it. He will assume his new duties in July in preparation for the opening of the next school year. Dr. Thomson has been dean of the School of Mines at the University

of Idaho for the past 11 years. Before that he was professor of mining at Washington State College. He has had considerable experience as an assayer, plant constructor, consulting engineer and mine superintendent. He is serving his second term as chairman of Columbia section, A. I. M. E., but his new move to the "richest hill on earth" at Butte will take him beyond the territorial limits of that section. Dr. Thomson built the School of Mines at Idaho to a high rank among technical institutions, and his friends are confident that the presidency of the Montana school, at Butte, will give him even greater opportunities.

Dickens Mill Contract Let

W. L. Zeigler of Wallace will construct the 200-ton mill for Dickens Consolidated Mining Company on Moon Gulch, under a contract awarded recently. Operation of the mill is expected to start in four months, according to President C. H. Whittum.

Coincident with this announcement it was stated that new ore reserves had been disclosed by the raise from the 500 to the 400 level. This ore body was not unexpected, but both in quality and extent it is apparently better than the average in the mine, according to a Wallace report. It is richer in lead with a correspondingly smaller zinc content.

Zinc Plant to Reopen

Increasing business prospects have led to the announcement that the zinc chloride plant at the East Plant operation of the New Jersey Zinc Company, which has been out of operation for several years, is being put into condition for resumption of work by May 1.

Between 15 and 20 men will be required to keep the plant working.

R. V. A. Norris Dies

The mining industry lost one of its distinguished authorities April 20 by the death of R. V. A Norris, 64, at his home in Wilkes, Barre, Pa.

He was born in Newark, N. J., and was graduated from the Collegiate School, New York, and from the Columbia School of Mining. In 1886 he turned his attention to anthracite mining and was made assistant engineer of coal mines for the Pennsylvania Railroad, then in control of the Susquehanna Collieries Company, and in 1900 was advanced to the post of chief engineer, in which capacity he served until 1904, when he engaged in private practice as a mining engineer.

He was a lecturer on coal mining at Harvard University and also a graduate Lecturer of Columbia University, New York.

Mining Companies Active in Safety Work

Most mining companies are doing good work in safeguarding their employes from accidental injury, according to a statement by Scott Turner, Director of the Bureau of Mines. The accident rates for the mining industry are, it is believed, at their present levels largely because of the less favorable accident experience of a relatively small percentage of operators.

Many mining companies, said Mr. Tuprner, have better records in accident-prevention work than the accident rates for the whole industry would lead one to believe. The Bureau of Mines recently examined the records of more than 200 mines and quarries and found that 69 percent of the bituminous coal mines, 73 percent of the metal mines, and 82 percent of the quarries and open-pit mines whose records were examined had individual safety records that were more favorable than the average accident rates for their respective groups. These records related to the year 1926. Similar records for 1925 were also examined, and showed 61 percent of the bituminous coal mines, 62 percent of the metal mines, and 86 percent of the quarries and open-pit mines had accident rates that were more favorable than the average rates for their respective groups. These records were taken as relative samples and are believed to be more or less representative of the entire mining and quarrying industries.

It is mainly to the few companies, said Mr. Turner, that the industry looks for substantial improvement so that the present favorable record of a majority of the companies may become more typical of the industry as a whole.

"Mechanical Loading Underground in Metal Mines," a project before the American Engineering Standards Committee and sponsored by the American Mining Congress, has been approved as Recommended American Practice. The date of approval is April 2, 1928, and the A. E. S. C. designating number is M 19-1928.

Copies of this standard may be obtained from the American Mining Congress.

Bethlehem and U. S. Steel Corporations Coal Production

Reports of the United States Steel Corporation and of the Bethlehem Steel Corporation show that these organizations produced from their mines in 1927, 34,812,955 tons of coal as compared with 41,590,013 tons in 1926 a decrease of 6,677,058 tons. Of this tonnage the output from the mines of the United States Steel Corporation was 27,430,329 tons, a decrease of 6,864,328 tons or 20 percent from the production of 1926, while the Bethlehem Corporation produced 7,382,626 tons in 1927 and 7,295,356 tons in 1926, an increase of 87,270 tons over the previous year.

A total of 19,064,903 tons of coke was manufactured by both companies, the United States Steel Corporation making 14,506,980 tons and the Bethlehem Corporation 4,557,923 tons. In 1926 the output was 17,336,334 tons for 1927 of 3,-236,158 tons. The United States Steel Corporation had on its coal and coke properties payroll during 1927 an average of 21,705 employes per month as compared with 25,985 in 1926, a decrease of 4,281.

New River & Pocahontas to Build Cleaning Plant

The New River & Pocahontas Consolidated Coal Company, a Berwind Interest, recently purchased from the American Coal Cleaning Corporation of Welch, West Virginia, a pneumatic coal separating plant for their Newhall Mine, having a capacity of 200 tons per hour in treating Stove, Nut, Pea, and Slack coal, 2-¾ in. to 0 in. This makes the second large plant purchased by this company during the past year, the first plant having been in operation during the past three or four months and treating identical sizes.

This plant will contain the latest system of dust collection and air filtration, this company having the only two such air filters of this type in America. This system does not permit the escape of any dust laden aid to the atmosphere, thereby overcoming one of the early objections to this method of coal cleaning, the plant which has been in operation having proven 100 percent efficient.

The demand of both domestic and industrial consumers for coal produced by the older plant were in excess of its production and therefore made it necessary to contract for the additional installation.

Northern West Virginia Merger

Ways and means of perfecting the merger of principal coal producing companies in the northern West Virginia coal field, comprising twelve and one-half counties, were discussed by members of the central committee of operators in Clarksburg, April 13.

A Lisle White, chairman, presided, and the following attended: V. L. Highland, John F. Phillips, Harry B. Clark, Carl L. Hornor and Thomas R. Craig, all regional operators, and Mark M. Jones, New York.

Although no definite day has been set for the gathering, it is stated that the committee expects the preliminary

phases of the meeting to be completed at a meeting of the Marion county operators to be held in Fairmont.

Approximately 17,000,000 tons of the 30,000,000 tons produced in the field already have been pledged to the project. A minimum of 22,000,000 tons is required to assure the success of the movement, it is expected that more than the needed difference will be pledged in a meeting to be held by the Marion county operators.

Clinchfield Coal Awards Contract for Preparation Plant

C. E. Bockus, president of the Clinchfield Coal Corporation, has awarded a contract to Roberts & Schaefer, of Chicago, Ill., for the construction of a combination hydro-separator Arms air concentrator coal cleaning plant, to be of fireproof construction, for their No. 25 Mine at Dante, Virginia. The proposed plant will have a 100 percent dust collection and will have a capacity of 300 tons per hour.

J. M. Humphrey Elected President of Lehigh Valley Coal Company

John M. Humphrey, of Wilkes-Barre, Pa., was re-elected president of the Lehigh Valley Coal Co. at the annual meeting of the stockholders in Philadelphia. The other officers of the company were also re-elected.

Mr. Humphrey reviewed the outlook of the company and stated that the plan of amalgamation of the Lehigh Valley Coal Co. and the Lehigh Valley Coal Sales Co. would be submitted to the stockholders soon. He expressed the belief that the amalgamation would be brought about in a few months. As for the industry generally he asserted that anthracite is coming back very well and the future looks good. Competition from fuel oil has reached its peak, Mr. Humphrey thought.

Production of the Lehigh Valley Coal Co. last year exceeded 6,000,000 tons, all of which was sold to the Lehigh Valley Coal Sales Co.

Bureau's Chief Mining Engineer Visits England

Dr. George S. Rice, chief engineer of the United States Bureau of Mines, sailed April 14 for Great Britain where he will participate in numerous conferences and discussions concerning the various mining and safety problems, in line with the cooperative mining agreement between the United States and Great Britain, instituted in 1923. The Mines Department of Great Britain is constructing a series of tunnels in rock near Sheffield, which will be a gallery equivalent to the United States experimental mine and the views of Dr. Rice thereon have been solicited. Dr. Rice will also present a paper on the status of mine rescue work in the United States at the June meeting of the British Institution of Mining Engineers.

Edward N. Zern Dies

Edward N. Zern, 49, died at Crafton, Pa., Sunday, April 8.

Mr. Zern was well known to the coal mining fraternities throughout the United States, receiving his B.S. degree from Penn State College in 1903, followed by his mining engineering degree from the University of Pittsburgh. He was mining engineer, West Kentucky Coal Co. and Pitcairn Coal Co., 1905-1907; mine superintendent, H. C. Frick Coal Co. and Jamison Coal & Coke Co., 1907-1911; professor of oral mining at the University of Pittsburgh, 1911-1912; head of the Department of Mining, University of West Virginia, 1912-1917, at which time he inaugurated mining extension work in West Virginia. He has written a large number of articles bearing on mining subjects used in extension courses, not only in West Virginia, but in a number of other states. In 1917 he moved to Pittsburgh, at which time he became editor of the Coal and Mining Catalogs, in which will be found a number of treatises on coal mining subjects and a variety of articles on the geology and usage of coal to be found in the coal catalog.

He was secretary of the West Virginia Coal Mining Institute, 1912-1917; president of the Coal Mining Institute of America, 1919, also a member of the A. I. M. E., American Mining Congress.

Personal Items

Ira B. Joraleman, consulting mining geologist of San Francisco, has returned from a business trip to New York.

R. H. Channing has returned to San Francisco after an extended stay in New York.

H. C. Carlisle, consulting mining engineer of San Francisco, recently made several mine examinations in Arizona.

Walter Congdon, of Duluth, Minn., made a tour of inspection of the properties of the Calumet and Arizona Mining Company in Arizona during April.

Kenneth Duncan, who has been superintendent of the Zenith Mine at Ely, Minn., for some years is now superintendent of the Dunwoody mine, at Chisholm, Minn. Both properties are operated by Pickands, Mather & Company.

Lucien Eaton, district superintendent for the Cleveland Cliffs Iron Company at Ishpeming, Mich., is in southern Russia on special work for the Russian Government.

Robert D. Longyear, president, and P. W. Donovan, manager, of the E. J. Longyear Company, of Minneapolis, were in San Francisco for the meeting of the American Association of Petroleum Geologists.

W. G. Pearsall, mining geologist with the Adbar Development Company, of Duluth, has been in the southwest.

W. A. Knoll has been made superintendent of the Palms-Anvil and Plymouth iron mines operated by Pickands, Mather and Company.

Guy Ruggles, mill superintendent for the Inspiration Consolidated Copper Company, was in San Francisco for the national conference of Boy Scout Directors.

R. H. McGhee, who has been connected with the Mine Safety Appliances Co. of Pittsburgh, has been appointed mine inspector for the Kingston-Pocahontas Coal Co., his appointment having become effective April 1. Before becoming connected with the Mines Safety Appliances Co., Mr. McGhee was connected with the Grasselli Power Co. for several years.

At the last annual meeting of the stockholders of the Pittsburgh Coal Co., James Carstairs, E. M. Love, Augustus K. Oliver, W. A. Reiss and W. G. Warden were reelected directors.

Dean E. A. Holbrook, of the schools of engineering and mines of the University of Pittsburgh, has been appointed by the American Institute of Mining and Metallurgical Engineers as one of the three members of the American Engineering Standard committee.

George Anderson was elected president of the Consolidated Coal Company at the annual meeting of stockholders recently, succeeding former United States Senator C. W. Watson.

Walter Barnum, president of the Pacific Coast Company, and a former president of the National Coal Association, was a passenger on the Ile de France, which sailed from New York recently. He was accompanied by Mrs. Barnum and will return the latter part of May.

John Hampton Barnes, James D. Winsor, Jr., and Edward B. Leisenring yesterday were elected directors of the Westmoreland Coal Company at the annual meeting.

Harry S. Gay, general superintendent of the Gay Coal & Coke Co., formally launched his candidacy for renomination as a Republican member of the legislature from Logan county.

A. C. Watts, assistant to the president of the Utah Fuel Co. and with the company for about 21 years, has resigned. J. P. Russell, assistant engineer of the company for nearly 20 years, has resigned to accept the position of engineer for the Peerless Coal Co.

George Baker, well known mining man of the Williamson field, West Virginia, has been made general manager of the Tierney Mining Co.'s operations, on Pond Creek, it has been announced at the Bluefield offices of the company. Mr. Baker succeeds the late G. C. Wood. Prior to his elevation to the general managership, Mr. Baker served in the capacity of chief engineer of the Tierney Mining Co.

COURTS UPHOLD SOUTHERN ROADS' REDUCTIONS IN LAKE CARGO COAL RATES

AN INJUNCTION restraining the Interstate Commerce Commission from permanently suspending a freight rate reduction of 20 cents a ton on lake cargo coal offered by four southern railroads, was granted April 14 by the United States Circuit Court for the southern district of West Virginia, at Richmond, Va.

Citing three errors in the ruling of the commission entered last February 21, the court held that the commission exceeded its power and had proceeded upon erroneous theories of law. Declaring the commission's action was an effort to equalize industrial conditions or to offset economic advantages by rate adjustments not "warranted by anything contained in the transportation act of 1920 or in the Hoch-Smith resolution," the court asserted the commission had erred, as a matter of law, in holding that the burden was upon the carriers, who filed schedules reducing rates, to show that the rates as reduced were not unreasonably low.

Written by Judge John J. Parker, of the United States Circuit Court of Charlotte, N. C., the opinion was concurred in by United States Circuit Judge Elliott, of Henderson, W. Va., and United States District Judge George W. McClintic, of Charleston, W. Va., the other two members of the court.

The United States Supreme Court on April 17 refused to grant a stay of the injunction awarded by the Federal Court sitting at Richmond.

As a result, the lower rates, which the Interstate Commerce Commission refused to allow, went into effect April 20, and will remain in effect until the Supreme Court has passed upon an appeal by the Government from the Richmond decision. A final disposition of the case is not now expected before the coming fall.

A suggestion of the Lake Rate Committee of the Pittsburgh coal operators that the New York Central, Pennsylvania, and Baltimore and Ohio Railroads reduce lake cargo coal rates to meet the cut made by Southern roads will be given careful consideration by the roads, the committee was advised by the railroad presidents.

Daniel Willard, of the Baltimore and Ohio, said: "We appreciate fully the situation created by reduction of coal rates in Southern regions.

"The questions involved, however, are so serious and far-reaching that I do not think we should take hasty action. A meeting with Southern railway executives is being arranged for and until that conference has been held I do not think it would be advisable to change the existing status. I hope some equitable and satisfactory basis of adjustment may be found and we will make every possible effort to bring about such an adjustment at the earliest possible date."

W. W. Atterbury, of the Pennsylvania, said: "We thoroughly appreciate the importance of this situation and the matter is under active consideration."

P. E. Crowley, New York Central, replied: "Fully appreciate situation of Pittsburgh operators but it is difficult at the moment to determine just what remedy can be applied. The matter will have careful consideration."

In its telegram to the railroad executives the committee urged an immediate lake cargo reduction "to protect the lake traffic you should enjoy from Pittsburgh district coal operators."

Last year the four Southern States shipped 10,000,000 tons of bituminous coal to the lake ports. When the commission overturned the rate balance existing between the Southern fields and those in Pennsylvania and Southern Ohio, giving the Northern industry the advantage, it was claimed by the Southern interests that the Great Lake cargo market had been taken away from them.

But the Richmond decision, supported for the present by the Supreme Court, comes at a time when the thawing of the lakes means the beginning of a new season that will last late into next autumn. The Southern operators expect again to get the bulk of the business.

James D. Francis, chairman of the committee acting here for the Southern operators, declared that $10,000,000 in wages to coal workers and a like amount for railroad employes would be entailed in the handling of the movement. In other quarters an actual profit of at least $1,000,000 to the operators was cited and it was asserted another $10,000,000, at least, would be distributed in the four states, mainly Kentucky and West Virginia.

Success of an underground school established at Dawson, N. M., for training inexperienced miners leads to the hope that other mining companies can be induced to establish similar schools this year with federal aid, D. W. Rockey, state supervisor of trade industrial education, reported to Gov. R. C. Dillon, a short while ago. The Phelps-Dodge Corporation has been meeting federal funds for the Dawson school and enough is available for two or three others, he said.

National Coal Association Dates Changed

The Eleventh Annual Meeting of the National Coal Association, which was to have been held at Cleveland, Ohio on May 23, 24 and 25, will be held instead on November 14, 15 and 16 in Cleveland.

The change in date from the previous announcement is due to the unexpected continuance of the Senate coal hearings which makes it inadvisable to proceed with the original plans. The interest of the industry is in a large measure centered on the hearings in Washington and it is, consequently, considered unwise to attempt the development of a comprehensive program, such as is called for by an annual meeting, in the face of divided interest of the industry.

Owing to the fact that the national political conventions will be held in June and will be attended by many coal operators, as is always the case, and the fact that July, August and until after Labor Day in September is broken up by vacation time, and further that because of election activities the early fall is not usually desirable for a national meeting of the character in question, the annual meeting committee, with unanimous approval of the board of directors, authorized Executive Secretary Gandy to make the announcement concerning the November dates.

Receiver for Knox Consolidated

Suit for a receiver for the Knox Consolidated Coal Co., the largest single producer of coal in Indiana, was filed April 16 in the Indianapolis Superior Court by Banus E. Neal, a stockholder and bondholder, who represented a majority of the stockholders. Judge Linn D. Hay appointed E. D. Logsdon, president of the company, as receiver.

Officials of the company said that the suit was a friendly action to conserve the assets of the company in the period of enforced suspension because of the depression in the coal industry. The company owns three large mines in Knox county, Ind., together with 6,500 acres of coal lands and rights. Four of its five mines have been idle since April 1, 1927, and the fifth since April of this year.

The suit recites that the company is under a monthly charge of $22,000 for insurance, taxes and care of property, and that it has $3,500,000 of bonds outstanding, on which $617,500 will be due in interest and maturities by August 1, 1929. It is set forth also that the company has approximately $560,000 of working funds, consisting of money in hand and accounts receivable, and that a receiver is necessary to safeguard these funds so that the company will be in position to resume operation when conditions in the coal industry improve.

Sloss-Sheffield Steel & Iron Co.

The Sloss-Sheffield Steel & Iron Co. has contracted for the erection of about 150 dwellings for Flat Top employes at Alden, Ala., near its Blossburg division mines. Flat Top mines are now being operated under a contract with the state, convict labor being employed. All convicts will be removed from the coal mines June 30, and hence it became necessary to build a new camp to house the free labor which will take up the work in their place. It is understood that the opening located near Blossburg, will be used as a manway for the men to reach the Flat Top workings, thereby greatly reducing the distance the employes will have to travel to their work. The Flat Top mine is the company's largest colliery and it is planned to maintain production without interruption due to the change over in labor from convict to free.

DeBardeleben Annual Meeting

The annual meeting of the stockholders and directors of the DeBardeleben Coal Corporation was held March 27 and reports covering operations for the past year and plans for the current year were made by officials of the corporation. Records showed a slight increase in the total coal production for 1927 over 1926. Improvements have been made at the mines of the corporation in Walker county recently which will bring about a large increase in production and greatly facilitate the handling of the output, a large number of new tram cars having been placed in commission and changes made in tipple arrangements to expedite the handling of coal. Officers elected for the ensuing year were: H. T. DeBardeleben, president; Milton Fies, operating vice-president; Edgar L. Adler, vice-president; H. F. DeBardeleben, vice-president, and G. M. Bowers, secretary-treasurer.

The National Devonian Process Company has applied to the Securities Commission of Utah for a permit to offer for sale $20,000 worth of additional stock and for the release of $30,000 realized from a previous stock selling campaign, this money being held in trust by the commission. The company, which owns the Jensen patents for processing coal, was requested to submit plans and specifications for a proposed experimental plant before final decision is made. The company wants to sell additional shares to raise funds for construction of an experimental plant. It is said that the original stock was sold with the expectation that the Smokeless Fuel Company would furnish half of the funds for the proposed plant, but this agreement has since been dissolved, Devonian company officials said.

IS REHABILITATION OF HYDRAULIC MINING IN CALIFORNIA FEASIBLE?

Mineral Resources Section Of The Commonwealth Club Makes Favorable Report

THE feasibility of the "Rehabilitation of Hydraulic Mining in California" was discussed at the monthly meeting of the Commonwealth Club of California on Thursday, April 19, 1928. The club's Section on Mineral Resources has devoted the past 10 months to a study of this question. In this the section has acted as a fact-finding commission. Representatives of the hydraulic miners, the agricultural interests, the power interests, navigation interests, and of the various interested state and federal commissions have appeared before the section to submit their views. The voluminous information submitted has been sifted and studied by the committee, which has submitted a majority report, recommending the resumption of hydraulic mining where the mining débris can be stored behind suitable dams.

The majority report, presented by Walter Stalder, chairman of the section, follows:

"Careful consideration of the papers presented on question of resumption of hydraulic mining in California and of the discussion thereon leads your committee to present the following conclusions:

"That it is to the interest of the state to render possible the recovery of at least a considerable percentage of the gold remaining in the gravels of the Sierras, provided this can be done without prejudice to the interests of the farmers and others in the valley, or to the public interest in maintaining the rivers in a navigable condition. The resolution of the Section on Harbor Development effectively clears the latter proviso, and we think that it has been well established during the course of our discussions that the débris can, within limitations prescribed by the Débris Commission, be stored behind dams of modern construction. The contention of the opponents to rehabilitation that material other than natural erosion products will pass over the crest of such a dam after the remaining storage has filled with such natural erosion products, we think is erroneous and untenable.

"The benefits arising from the limited and regulated resumption of hydraulic mining are general: The miner will benefit directly to the extent of his possible profits from operation, to which he is entitled. The farmer will benefit, for a temporary period at least, by the storage of the natural erosion products, which otherwise pass unimpeded during flood periods, and, in addition, the farmer, in common with other lines of business, will benefit from the increased market created; labor will benefit, as will the community at large, by increasing employment; and the commonwealth will benefit by the addition to the Nation's wealth. It seems inconceivable that all this potential wealth should continue to be locked up indefinitely in the hills. There seems, therefore, to be a community of interest that will justify the state in aiding, at least to the extent of standing the cost of engineering investigations, in order to assist in putting this industry back on its feet.

"Much of the argument of the opponents has been directed toward attempting to show that hydraulic mining can not be carried on at a profit (though this argument is illogically coupled with the expressed fear that if once started it will never be stopped until all the available gravel is washed). It seems to us that this is a matter for the miner to determine. It has been conclusively shown that there *are* large bodies of gravel already stripped which can be effectively washed by modern methods at a profit, given a sufficient water supply and provided cost of storage of tailings is not excessive. It is evident, however, that storage can not be provided by construction of dams for this purpose alone. Otherwise, such dams would have been built already, under the provisions of the Caminetti Act.

"This leads us to a consideration of the various purposes a dam may serve. In the case of water storage a constant head is not maintained, and the draw-off is from the bottom. Such a dam provides a reservoir of water which can be utilized as needed, either for power or merely for flood control by turning the water back into the channel to empty the reservoir. Most of the dams already built in the Sierras serve one or more of these purposes, and dams built in the future primarily for flood control would be of this same general purpose.

"Now, it is manifest that débris can not be stored behind such a dam without defeating the purpose for which it is built: The storage would be reduced and the operation endangered.

"The Bullard's Bar Dam was built with an entirely different purpose in view, viz, to supply water under constant head for power purposes, and to sell débris storage behind it in order to minimize the investment. Such a dam must be kept full to serve its purpose,

and serves no purpose of water storage or flood regulation, as the flow over the top is always that of the normal flow of the stream. It is with this type of service that we are concerned. A combination of the two types is, of course, possible, in which the lower portion serves for debris storage and the upper for water storage, with the drawoff at or near the bottom of the upper portion.

"Now, the total available storage in the canons of the Sierras is limited. It has been estimated that were the entire capacity utilized for flood control, it would at best take care of about one-seventh of the mean annual runoff. The question for the people of California to decide is how the remaining storage capacity can best be used to their greatest benefit. This question is too large for this committee to attempt to decide.

"One of the points stressed by the proponents of rehabilitation is that some at least of the hydraulic pits will ultimately serve for water storage to an extent at least equivalent to the stream storage used. Such storage will be of more permanent value than the equivalent stream storage could possibly be, as it provides for storage of waste waters that otherwise will be lost in runoff, with no filling up by products of natural erosion. These waters will be made available for use both for power and subsequently for irrigation at a period of scarcity. A double duty can thus be secured for power purposes, as not only will the height above the stream be utilized in available head, but the water thus freed will be used again at the dam for additional power, and at lower levels for irrigation, thus benefiting everyone concerned.

"It seems to us that the solution lies in the development of these projects by private enterprise in those areas where the holdings or consolidations are of sufficient size and financial ability to do so, along similar lines to those under which the Bullard's Bar Dam was constructed, in which both power and débris storage are the considerations. In those areas, however, where there is a multiplicity of ownerships, we recommend that the state and/or Federal Government can justifiably and should assist in the engineering investigations and possibly in the building of such dams. Such governmental participation will not impair the right of injunction by anyone who may be injured by such operations. In either case, private or governmental construction, the project would be under the jurisdiction and regulation of the California Débris Commission under the authority of the Caminetti Act as contemplated in that act.

"Regarding plans for financing, it is likely that with those projects which can be developed by private capital, with a view to power development primarily and of débris storage secondarily, there will be no need to ask for governmental aid in building and necessary dams; but for other projects it is suggested as a financial solution of the problem that when a hydraulic miner or a group of hydraulic miners can demonstrate to the California Débris Commission by satisfactory business guarantees with reputable power purchasers for water power and (or) irrigationists for water, and (or) a fair charge for storing hydraulic mining débris, that a dam for hydraulic mining débris and these or other accessory purposes will amortize itself in 25 years with interest at 5 percent, then the United States Government advance all funds for the purpose of constructing such dams. It is suggested further that all such funds be derived from royalties from United States Government lands in the State of California, accruing or accrued under the provisions of the mineral leasing act of February 25, 1920. All funds so provided are suggested to be considered as appropriations by Congress to fulfill the provisions of the Caminetti Act of 1893."

Otto Von Geldern, consulting engineer, representing those who are opposed to the Rehabilitation of Hydraulic Mining, presented a minority report, in which he stated that the agriculturists of the Sacramento Valley were unalterably opposed to the resumption of hydraulic mining on general principles. They feared that an enterprise which had injured them in the past was likely to be a menace in the future. He presented arguments at some length tending to show that hydraulic mining on a limited scale behind expensive dams could not be profitable and mining would stop before the cost of the dams had been returned from payments for storage space. And yet a strong fear was expressed that if hydraulic mining were once resumed it would not be stopped until all the available gravel was washed.

A well-prepared paper reviewing the work of the committee, and the basis of its findings, was presented by Abbott A. Hanks. He reviewed the history of hydraulic mining, the damage done to farming lands by unrestricted hydraulic mining and the fight between the farmers and hydraulic miners which followed. He then gave an outline of the possibilities in rehabilitation of the industry on a limited scale and with provision for the storage of débris behind modern concrete dams.

James D. Stewart, of Auburn, Calif., ably presented "The Miner's Viewpoint." Mr. Stewart was born in the atmosphere of hydraulic mining and has been intimately connected with the industry throughout his life. He is well qualified to present the case for the miners, and did so in a forcible way.

Discussion from the floor under the five-minute rule brought forth many speakers both for and against rehabilitation and the discussion was at times decidedly warm.

FLUORSPAR IN 1927

THE fluorspar shipped from mines in the United States in 1927 amounted to 112,546 short tons and was valued at $2,034,728, as compared with 128,657 tons, valued at $2,341,277, in 1926, according to the Bureau of Mines. There were decreases of 13 percent both in quantity and in total value as compared with 1926. Fluorspar was shipped from Colorado, Illinois, Kentucky, and New Mexico in 1927, but New Mexico was the only state to record an increase.

The reported shipments of fluorspar to manufacturers of enamel and of hydrofluoric acid were more than in 1926, but the shipments to manufacturers of iron and steel and glass were considerably less and the quantity exported was the smallest since 1921.

The general average value per ton f. o. b. shipping points for all grades of fluorspar in 1927 was $18.08, which is 12 cents less than the average for 1926. The general average value of the fluorspar shipped to steel plants in 1927 from the Illinois-Kentucky district was $16.59 a ton and from the Colorado-New Mexico district $13.72 a ton. These values compare with $16.98 for the Illinois-Kentucky district and $12.69 for the Colorado-New Mexico district in 1926. This difference in average values represents rather the differences in freight costs from the mines to consuming centers than differences in quality of fluorspar from these two districts.

According to the reports of producers the stocks of fluorspar at mines or at shipping points on December 31, 1927, amounted to 21,208 short tons of gravel fluorspar, 1,857 tons of lump fluorspar, and 385 tons of ground fluorspar, a total of 23,450 tons of "ready-to-ship" fluorspar. In addition there was in stock piles at mines at the close of 1927 about 49,000 short tons of crude (run-of-mine) fluorspar which must be milled before it can be marketed and which is calculated to be equivalent to about 29,000 tons of merchantable fluorspar. These stocks compare with 20,731 tons of "ready-to-ship" fluorspar and 48,266 tons of crude fluorspar on December 31, 1926.

The total imports of fluorspar into the United States in 1927, amounting to 71,515 short tons, represent a decrease of 5 percent from the record year 1926, but are the second largest ever recorded. The imports in 1927 are equivalent to

64 percent of the total shipments of domestic fluorspar, as compared with 59 percent in 1926.

The United Kingdom, which has been the chief source of the imported fluorspar, supplied only 26 percent of the total in 1927, the imports of 18,449 tons therefrom representing a decrease of 37 percent. Germany was the chief source of imports in 1927, supplying 45 percent of the total. The imports from Germany in 1927 were 56 percent more than in 1926. France was the only other source from which more fluorspar was imported in 1927 than in 1926.

Book Reviews

UNDEVELOPED MINERAL RESOURCES OF THE SOUTH—*By Dr. Henry Mace Payne.* Published by The American Mining Congress, 368 pages, bound in cloth, price $5.00.

"The Undeveloped Mineral Resources of the South" is the title of a publication just released by The American Mining Congress. The information is extremely well presented by the author, who is a widely-known mining engineer, and for many years consulting engineer for the publishing organization. The book should have an extensive circulation throughout industry, .especially where real information is required as to the mineral possibilities of our Southern States.

In his opening statement Dr. Payne says: "The book is not offered as a strictly technical or geological work, but rather as a 'commercially convenient' compilation of the mineral resources of the South, designed to afford the student, the consumer, the investor, and the producer a ready source of information regarding the nature and extent of these minerals; how they may be identified; where additional supplies have been proven up, or areas whose surface indications warrant further prospecting; what economic factors have speeded, retarded, or prevented their development; and new avenues of outlet for the product."

This work embraces all available information of the undeveloped mineral resources in the several Southern States from Virginia to Texas. It epitomizes the work of the U. S. Geological Survey, the several State Geological Surveys, the industrial agents of the more than 50 railroads operating in the South, which after due compilation was supplemented by several years of personal field work. This information after correlation was then made of greater value by the inclusion of every known use to which the more than 100 minerals found in the South could be put. A complete bibliography constitutes the closing chapter and the whole volume is concluded with a detailed engineering cross-index. Divided into 26 chapters with subheads and specially designed typography the book is believed to be the most complete volume of its kind ever printed.

NATURAL RESOURCES AND NATIONAL PROBLEMS—*By Dr. Henry Mace Payne.* Published by The American Mining Congress.

This little volume is published and released simultaneously by The American Mining Congress with the volume on "The Undeveloped Mineral Resources of the South." It is entirely an economic treatise upon the problems that affect present-day industry, and includes chapters on "Interdependence of Agriculture and Industry," "Labor and Immigration," "Economic Development of Power," "Power Development and Industry," "Public vs. Private Ownership," "Summary of Mineral Resources in the South," "Transportation and Freight Rates," "Taxation," "Super-Power and Interconnected Zones."

J. F. Callbreath, Secretary of The American Mining Congress, in a foreword, gives the following reasons for the presentation of this information by his organization:

"In presenting this, the first of two volumes by Dr. Payne, The American Mining Congress is actuated by a lively desire to call the great mineral resources of the South to the attention of the Nation. But more than this, it desires to point the way to the manufacturer who is looking for opportunity, for new markets, for new sources of raw material and for better labor and cheaper power. Clays, gravel and even coal move within a limited radius, but when manufactured into brick, tile and earthenware, they may be sold for the construction of new homes and factories at more distant points. These, in turn, call for cement, good roads, and increased consumption of mined and quarried products.

"The American Mining Congress offers these contributions as an authoritative basis for industrial development. The present volume, which only summarizes the great resources of the Southern Mineral Empire, discusses certain economic problems upon the solution of which depends the opening up of this vast storehouse. The second volume deals exhaustively with each separate mineral, its uses, the transportation facilities available, and the competing markets and sources of supply.

"It is the aim of The American Mining Congress to assist in every practical way in bringing to the South the additional capital necessary to the more complete utilization of its vast mineral wealth."

GREAT VALLEY ANTHRACITE CORPORATION

(*Continued from page* 336)

track. Under each bin is a motor-driven degradation shaker screen and the oversize feeds to a scraper type loading conveyor, which in turn delivers the product to a rubber-belt loading boom.

By this arrangement all sizes are loaded on one track and any mixture of sizes can be made by drawing off from different bins at the same time, and the undersize or degradation from the loading screens is returned to the main feed belt and thence to the sizing screens over the bins.

The proximity of the New River made the supply of wash water ample, but the variation in stage of the river complicated the problem of pump installation. However, after considering various schemes, it was decided to install the pump below low-water level. An open top, circular caisson, 20 ft. diameter by 22 ft. high, was built alongside the river bank. The bottom of this pump pit is 4 ft. below low water and the top 2 ft. above high water. By careful mixture of concrete and the use of "Celite" in 1 x 1½ x 3 proportion, a thoroughly watertight job was secured, and there is absolutely no leakage, even at the points where the suction and discharge lines enter and leave the pit.

As may be noted from the photographs, none of the plant is "square with the world." Surface contours largely dictated the location for railroad, hoist house, washery, and screening plant. Even so, the entire plant adapted itself very well to the irregular contours, excepting the hoist location.

It was impossible to secure a satisfactory site for the hoist and still locate it on the axis of the main slope. A horizontal sheave 8 ft. in diameter was introduced, and the hoist rope makes a quarter turn around this sheave. No trouble has been experienced due to this horizontal sheave, but the expense of a steel tower 22 ft. high to support it was no small item, and the amount of concrete foundation required to prevent overturning was more than that required for the hoist foundation.

Although there is a fairly good supply of labor from the neighboring communities, quite a nice camp has been established at the mine, with a boarding house and 25 modern four-room houses. An excellent water system and electric lights make the Great Valley Camp a very attractive place, especially as it overlooks a beautiful view of the New River Valley.

The plant was started in November, 1926, and the first coal was loaded July 1, 1927. Production has reached a maximum of 1,000 per day, and the main slope has been continued until it is now 1,700 ft. from slope mouth.

WITH THE MANUFACTURERS

Link-Belt's New "Jax" Face Conveyor

A new face conveyor for coal mines, known as the "Jax," has been designed by the Link-Belt Company, Chicago, Ill.

It is built light enough so that one man can move it easily and hurriedly and makes an ideal unit for work close to the face and under tender roofs.

It is mounted on agricultural type wheels of 14-in. diameter and 2-in. face, a 12-ft. conveyor complete with motor, weighs 640 pounds; and the 15-ft. conveyor, complete with motor, 710 pounds.

The wheels are movable to practically any point along the entire frame, which consists of two heavy pipes tied together at head and foot ends by electric steel castings.

The casting at the head end provides a base for the motor and a grease-tight inclosed housing in which the cut reduction gears operate. All shafts are provided with anti-friction bearings.

The belt for carrying the coal is supported on its underside on a steel plate forming skirt boards to prevent spillage of the coal.

The steel-carrying plate and skirt boards are designed to prevent the fine coal from packing under the belt, thus decreasing the power load on the motor and preventing undue wear on the belt.

The height of the discharge point of the conveyor can be adjusted by moving the wheels forward or backward along the conveyor frame. The wheels are also provided with three positions for vertical adjustment.

Largest Locomotive Feature of Westinghouse Exhibit at Cincinnati

Visitors attending the Cincinati convention and exhibition this year will find an unusually complete and interesting display of many new types of electrical apparatus and some new developments of older types at the Westinghouse exhibit.

A most interesting part of the Westinghouse electric exhibit will be a 38-ton, 36-in. gauge, 3-axle, 6-wheel main haulage locomotive, with a total capacity of 399 hp. and semi-magnetic series parallel control. This locomotive is one of the two purchased recently by the Berwind White Coal Mining Company of Philadelphia and Windber, Pa.

Due to limit on motor size, imposed by narrow gauge, the required motor capacity has been increased by means of forced ventilation. The motor has through bolts in the axle caps, Timken roller bearings in the armature, and the armature shaft has an improved oil seal arrangement. Barsteel frame construction is used, semi-elliptic springs and large sized Timken bearings in the main journals. Improved three point equalization of wheels under operating conditions will be demonstrated. Mechanical parts are by the Baldwin Locomotive Works.

These locomotives will be used in underground haulage and should haul from 46 to 60 size 3½ ton gross weight loaded cars over grades varying from 2.37 percent to 5.6 percent, a distance of 21,150 ft., at an average speed of approximately 8.5 miles per hour, working against the average grade of operation.

A Knowles Grid-Glow Tube, so sensitive that it is operated when the hand is brought close to a crystal ball attached to the grid of the tube, will be connected to a permissible controller, which in turn will operate a permissible type motor. This motor has passed all tests made by the Bureau of Mines, and may be used with safety in gaseous or dusty locations when its application has been approved by the bureau. The apparatus will be so arranged that delegates can operate the motor by simply bringing their hands near the crystal ball. It is the same crystal ball that was used last spring by the late Judge Gary in starting the Homestead Steel Mill from his office in New York. The current flow caused by the movement of the hands amounts to less than one billionth of an ampere, being all that is required to operate this tube.

Among the other exhibits will be three display boards of overhead electrical equipment, a motor for room hoist service, a sectionalized SK motor, and some developments in renewal parts equipment.

New Switch Throws Motors Across the Line

A new magnetic switch, suitable for throwing squirrel-cage motors directly across the line, or for use as a primary switch for a wound-rotor motor the secondary of which is handled by a drum controller, has been introduced by the General Electric Company. It bears the General Electric designation CR-7006-D-31.

This switch consists of a triple-pole, restricted-blowout type, magnetically operated contractor with normally open interlock, and two hand-reset, temperature overload relays, all mounted on a molded base and enclosed in a drawn-shell, steel enclosing case. It is designed for use on standard voltages and frequencies.

Automatic Brake Permits Push Button Control of Super-Synchronous Motors

An automatic brake, announced by the General Electric Company for use with its super-synchronous motors, eliminates the necessity for manual braking of the rotating stator. It is claimed that all the desirable features of hand braking are retained.

The brake mechanism consists of an upright standard which supports a vertical shaft. The lower part of this shaft is threaded. When it is revolved it transmits motion, through a trunnion block, to a series of levers attached to the brake band. The driving motor for the brake is mounted on the side of the standard and is geared to the screw shaft. A wheel is mounted on the end of the shaft so that hand operation may be obtained at any time.

When the brake is being released, the trunnion block travels upward on the screw and is stopped by the tripping of a limit switch when sufficient clearance has been obtained between the brake band and the motor frame. In tightening the brake, the trunnion block moves down on the screw, automatically applying tension to the brake band through the combination of levers and weights until the action is topped by a limit switch. It is impossible for the brake to apply more torque than the amount corresponding to the weights on the brake lever. By adjusting these weights it is possible to vary the starting time of the motor over a reasonable period; for example, from 5 to 40 seconds.

The balancing of the weight and the closing of the band around the frame take place gradually. Over two seconds elapse after the band makes contact with the frame before full tension is established. This does not include the time taken to remove the slack from the band, which requires a few seconds. The tension is applied at the same speed, regardless of the amount of weight on the lever. Consequently, there is no sudden applica-

tion of torque to the driven machine. This makes a smooth start possible even when the brake is set for rapid acceleration. The two-second interval allows ample time for the application of torque to the load and still is not long enough to make the equipment sluggish when used to spot or jog the driven machine. After the brake is installed it requires very little adjustment.

Any slight expansion in the brake band is automatically compensated for. When the stator frame is brought to rest and the load is up to full speed, the driving motor is again started and the brake is given sufficient tension to lock the motor frame rigidly and prevent any slipping caused by shocks produced by the load.

Thus, with the automatic brake, hand operation is eliminated except when desired. The super-synchronous motor may be started or stopped by a push button.

The super-synchronous motor on which this brake is used is designed for driving loads when synchronous motors can be advantageously used, where loads require more than full load torque before synchronism is reached and on which it is desired to limit the power demand during the starting period to approximately full load values. This is possible by reason of the fact that it is so constructed mechanically that its pull-out torque is also its starting torque. Typical applications are centrifugal and other pumps where by-pass connections are omitted; air compressors where unloading valves are omitted; vacuum pumps; mine fans and other large blowers; crushing, grinding and pulverizing machinery in cement mills, rock crushing plants and ore dressing mills; paper mill pulp beaters; machines characterized by heavy flywheel effects, and machines difficult to start when stopped loaded with material.

New Line of Primary Cutouts for Distribution Systems

A new line of enclosed expulsion type cutouts has been designed by the General Electric Company. The new cutouts have very high dielectric strength, both for 60 cycle and impulse voltages. Current ratings and interrupting capacity ratings have been increased over those of previous designs.

The line comprises four cutouts rated as follows:

60 amp., 2500/4000 Y volts
60 amp., 7500 volts
150 amp., 5000 volts
150 amp., 7500/1250Y volts

The 60 ampere 2500/4000 Y volt cutout is of particular interest, as it introduces an expulsion cutout primarily designed for 2300/4000Y volt systems, which can economically replace plug type cutouts generally used on these systems.

The wet-process porcelain housings are of a fundamentally new design. The doors are of Textolite, a molded insulating compound, with handles of the same material, and may be opened simply by a pull of a standard switch hook. The fuse holder is supported by the door and is removed from the circuit when the door is opened.

The hanger for the 2500 volt cutout is fastened to the cross-arm by means of a lag-screw or through bolt, and holds the cutout in position about 30 degrees from the vertical. Hangers for the other three cutouts are made up of spring-thread insulator pins screwed into the backs of the housings. All hangers are suitable for any standard size of cross-arm and are designed to secure the cutout firmly without any possibility of damage to the porcelain.

There are no exposed metal parts except the hangers, and these are so proportioned with respect to the live internal parts as to minimize the possibility of condenser action. All internal metal parts are bonded together to prevent static arcing.

"100 and 1 Ways to Save Money"

Ingersoll-Rand Co., of 11 Broadway, N. Y., has just completed the sixth edition of its 140-page, two-color book, entitled "100 and 1 Ways to Save Money with Portable Compressors." In this book the company has embodied comparative cost data on its portable air compressors and air-operated tools (rock drills, paving breakers, clay diggers, backfill tampers, grinders, hoists, riveting hammers, chippers, metal drills, etc.). The information has been put together in handy-reference cross-index form. In most cases, figures are presented on a man-hour basis, so that they can be readily applied to local conditions in any part of the world.

Although no attempt has been made to establish large circulation figures, 125,000 of the books are already in the hands of readers. The fact that each copy in circulation represents a specific request indicates the genuine value of this publication. Free copies may be obtained by writing to Ingersoll-Rand Co., 11 Broadway, New York City, or any of its local branches in any part of the world.

On many classes of work, one man using a portable compressor and some one of the above-mentioned tools can do as much as ten men formerly did by hand, and do much better work in the bargain.

Ingersoll-Rand also manufactures a full line of the tools which are commonly used with portables; "100 and 1 Ways" contains accurate tables showing the number of tools that any given portable will operate; hence the company assumes full responsibility for the successful performance of the entire outfit.

It is interesting to note that this class of equipment has a much longer life than other kinds of construction machinery, as many of the portable compressor units that were put in service by the company 12 years ago are still in operation today.

Wrought-Iron Manufacturers Meet to Form Association

Representatives of the leading manufacturers of wrought iron in various parts of the country met in Pittsburgh April 5 and formed the Wrought Iron Research Association, the principal object of which is to gather and disseminate information about this time-honored metal.

The members of the Association are the American Swedo Iron Co., Philadelphia, Pa.; The Burden Iron Co., Troy N. Y.; A. M. Byers Co., Pittsburgh, Pa.; Cohoes Rolling Mill Co., Cohoes, N. Y.; Ewald Iron Co., Louisville, Ky.; Glasgow Iron Co., Philadelphia, Pa.; Highland Iron & Steel Co., Chicago, Ill.; Hughes & Patterson, Philadelphia, Pa.; Logan Iron & Steel Co., Philadelphia, Pa.; Lockhart Iron & Steel Co., Pittsburgh, Pa.; Penn Iron & Steel Co., and Pittsburgh Forge & Iron Co., both of Pittsburgh, Pa.; Reading Iron Co., Reading, Pa.; and Ulster Iron Works, Dover, N. J.

The executive committee consists of seven members, with offices as follows: George O. Boomer, vice president, Ewald Iron Co., Louisville, Ky.; Frank W. Hamilton, president, Ulster Iron Works, Dover, N. J.; J. M. Gillespie, vice president, Lockhart Iron & Steel Co., Pittsburgh, Pa.; L. M. Johnston, vice president, A. M. Byers Co., Pittsburgh, Pa.; Snowden Samuel, secretary, American Swedo Iron Co., Philadelphia, Pa.; L. E. Thomas, president, Reading Iron Co., Reading, Pa.; and William C. Wolfe, manager of sales, Highland Iron & Steel Co., Chicago, Ill. Mr. L. M. Johnston was elected president and Mr. Snowden Samuel secretary-treasurer of the Association.

Headquarters of the Association will be in Pittsburgh. The Association will endeavor to furnish engineers and laymen alike dependable information about the uses and properties of wrought-iron, and a publicity campaign will be started immediately, necessary funds having been provided.

Trico's Pittsburgh Office Moved

The Trico Fuse Mfg. Co., Milwaukee, Wis., makers of "Trico" Fuses, announce the removal of their Pittsburgh office to new and larger quarters at 405 Penn Ave. Mr. William A. Bittner and his staff are in charge.

Selection and Care of Wire Rope for Hoists and Shop Cranes

Wire rope as applied to shop cranes and electric hoists is frequently subjected to severe usage and not uncommonly to excessive overloads. Because of their very intimate relation with workmen and the necessity of swinging their loads over all floor equipment, the safety factor is a consideration of first importance in not only their selection but subsequent care.

According to the American Cable Co., ordinary shop cranes and hoists employ one of three types of wire rope, viz: 6 x 19, 6 x 37, or 8 x 19. Grade is usually of plow or improved plow steel, while drums and sheaves should have diameters not less than 30, 20, and 20 times the rope diameters in the order of rope types named. When in service on skull crackers, strippers, bridge cranes, or other equipment that continuously handles capacity loads, the wire rope should be of the 6 x 37 construction and the factor of safety no lower than 7. That is to say, the rated capacity of the hoist or crane should not cause a stress in the rope of more than 1/7 of the actual tensile strength of the rope.

Ropes on ladle or hot-metal cranes are more or less constantly subjected to high heat, and all such ropes should be supplied, in construction, with a 7 x 7 Independent wire-rope center. Subjection to considerable heat will char the hemp center of ordinary rope, with greatly reduced rope life and safety to workers as the result. The factor of safety on these ropes is usually 8 as a minimum, the minimum drum and sheave diameters 30 times the rope diameter, and the rope service limited to periods ranging from 9 to 15 months. In ladle crane application the wire ropes, with one or two exceptions, need to be stretched out on the floor before reeving on the crane in order that the rope may tend to "bird-cage" close to the equalizing sheave, and when this occurs rope life is materially shortened and workers endangered.

Theoretically, equalizing or compensating sheaves may not be considered as an operating sheave. Actually, however, there is a movement of the rope over such sheaves, and it must be admitted that nearly any movement will naturally set up wear or have abrasive tendencies. Rigid inspection should be made of the underside of the rope bearing on equalizing sheaves, since it is the hidden section that is the most critical.

All sheave and drum grooves should be inspected frequently for wear, as a worn sheave tread can do great damage to a rope. At the time rope replacement is made, strict adherence to rope size and sheave fit must be made the rule if proper rope service is expected or desired. A pinching sheave can do more damage to a wire rope in one hour than will a properly sized sheave in an entire week.

Another factor that is frequently responsible for early rope failure is lack of proper lubrication. Practically all the cores of good brands of wire rope are thoroughly impregnated with a commercial, chemically-neutral rope oil. While the core retains a liberal supply of this lubricant which gradually oozes out as the rope is used, still, frequent application of a good lubricant during service is necessary to prevent the core becoming dry and absorbing moisture, which will set up corrosion of the inner wires, or the outer wires from losing their film of oil. A rather thick, semi-plastic compound applied while hot and in a thinned condition is perhaps the best possible lubricant for hoist and shop crane ropes. In its heated state it will penetrate, after which, when cool, will constitute a plastic filler that will act in the dual capacity as a preservant and lubricant.

Acknowledgment is made to Walter Voigtlander, Rope Engineer of the American Cable Co., New York, for this data.

New President Combustion Engineering Corporation

George E. Learnard, president of International Combustion Engineering Corporation, New York, announces the resignation of Joseph V. Santry as president of Combustion Engineering Corporation, an American subsidiary of International Combustion Engineering Corporation, and the election of H. D. Savage, for many years vice president, as president to succeed Mr. Santry.

George T. Ladd has been elected vice chairman of the Board of Directors of Combustion Engineering Corporation.

Mr. Ladd is an authority in the design and manufacture of steam boilers, and has achieved marked success in this field, especially in connection with large units. Mr. Ladd is president of the Ladd Water Tube Boiler Co. and president of the Heine Boiler Co.

Mr. Savage has been identified with the development of pulverized fuel burning equipment since its very inception and is recognized as an authority on this subject. Prior to his entry into the pulverized fuel field, he was the active head of the Ashland Fire Brick Co. In 1914 he became vice president of the American Arch Co., and, two years later, vice president of the Locomotive Pulverized Fuel Co. When the Combustion Engineering Corporation purchased the Lopulco Pulverized Fuel System in 1920, Mr. Savage became associated with this organization as the directing head of the Pulverized Fuel Division.

Hazard Wire Rope Company Licensed to Make Preformed Wire Rope and Processed Fittings

Hazard Wire Rope Co., of Wilkes-Barre, Pa., has been given a license by the American Cable Co. to manufacture rope and fittings known under the trademark "Tru-Lay Preformed Wire Rope." A new type of fitting has also been developed which is known and advertised as "Tru-Loc Processed Fitting."

The Hazard Co. has for many years been recognized as a manufacturer of wire rope of high quality, and is probably the oldest manufacturer in its line in the United States.

Simplex Wire & Cable Co. announce the opening of a branch office at 1209 Empire Building, Pittsburgh, Pa.

Through cooperation with the Aldrich Pump Co. they have arranged for joint representation in the Pittsburgh District, their representatives being Messrs. J. E. Holvemk and T. L. Simpson.

The territory to be handled includes the mining districts of Pennsylvania, W. Va. and Ohio.

Wright Manufacturing Co., Lisbon, Ohio, manufacturers of chain hoists, trolleys, and cranes announces the sale of their business to American Chain Co. (Inc.), with executive offices in Bridgeport, Conn.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

Of THE MINING CONGRESS JOURNAL, published monthly at Washington, D. C., for April 1, 1928.

City of Washington,
District of Columbia, ss:

Before me, a notary public in and for the state and county aforesaid, personally appeared R. S. Mowatt, who, having been duly sworn according to law, deposes and says that she is the assistant business manager of THE MINING CONGRESS JOURNAL, and that the following is, to the best of her knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 411, Postal Laws and Regulations, printed on the reverse side of this form, to wit:

1. That the names and addresses of the publisher, editor, and business managers are:
Name of publisher, The American Mining Congress; post-office address, Washington, D. C.

Editor, E. R. Coombes.

2. That the owners are (give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 percent or more of the total amount of stock): The American Mining Congress—a corporation, not for profit. No stockholders. J. G. Bradley, president, Dundon, W. Va. Robt. E. Tally, first vice president, Clarkdale, Ariz. Geo. B. Harrington, second vice president, Chicago, Ill. J. F. McDonald, third vice president, Leadville, Colo. J. F. Callbreath, secretary, 841 Munsey Bldg., Washington, D. C.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are (if there are none, so state): None.

R. S. MOWATT,
Assistant Business Manager.

Sworn to and subscribed before me this 18th day of April, 1928.

[SEAL] THOMAS C. WILLIS.

(My commission expires January 4, 1932.)

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Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

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Hercules Powder Co., Wilmington, Del.

BATTERIES, DRY (for Bells, Buzzers, Signals, Blasting)
National Carbon Co., Inc., 30 East 42nd St., New York City.

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Hyatt Roller Bearing Co., Newark, N. J.

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S K F Industries, New York City.

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Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

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Morse Chain Co., Ithaca, N. Y.

BELTS, Miners' Safety
Mine Safety Appliances Co., Braddock Ave. and Thomas Blvd., Pittsburgh, Pa.

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Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

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Diamond Drill Carbon Co., World Bldg., New York.

BITS, Diamond Drilling
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BLASTING POWDER
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Hercules Powder Co., 934 King St., Wilmington, Del.

BLASTING SUPPLIES
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BLASTING UNITS (Dry Battery)
National Carbon Co., Inc., 30 East 42nd St., New York City.

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General Electric Co., Schenectady, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York City.
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Robinson Ventilating Co., Zelienople, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

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BLOWERS (Tubing)
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Phillips Mine & Mill Supply Co., Pittsburgh, Pa.

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Diamond Drill Carbon Co., World Bldg., New York.

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Central Frog & Switch Co., Cincinnati, Ohio.

BRACES, RAIL
Central Frog & Switch Co., Cincinnati, Ohio.

BRACES, TRACK
Central Frog & Switch Co., Cincinnati, Ohio.

BRAZILIAN ROCK CRYSTAL
Diamond Drill Carbon Co., World Bldg., New York.

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American Rheolaveur Corporation, Wilkes-Barre, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.

BREAKERS
American Coal Cleaning Corpn., Welch, W. Va.

BREAKERS (Construction and Machinery)
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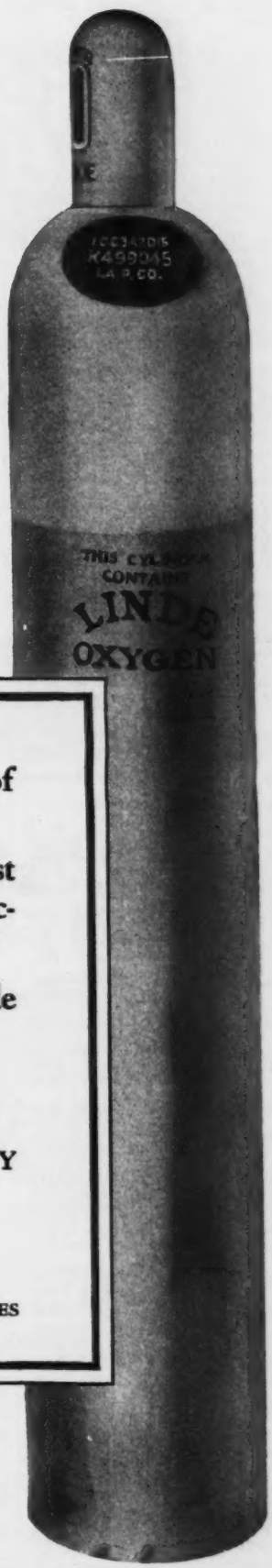

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Phillips Mine & Mill Supply Co., Pittsburgh, Pa.
Roberts & Schaefer Co., Chicago, Ill.

CAGERS, AUTOMATIC & MANUAL
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Roberts & Schaefer Co., Chicago, Ill.

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Vulcan Iron Works, Wilkes-Barre, Pa.

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Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

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The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
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Thorne, Neale & Co., Philadelphia, Pa.

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Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Vulcan Iron Works, Wilkes-Barre, Pa.

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Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

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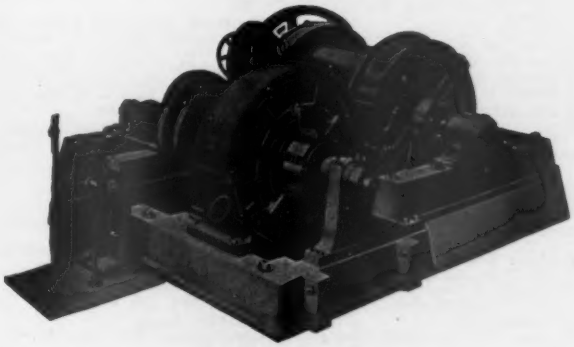

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The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Vulcan Iron Works, Wilkes-Barre, Pa.

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Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

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Roberts & Schaefer Co., Chicago, Ill.

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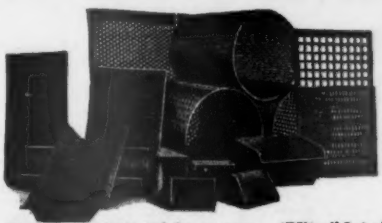

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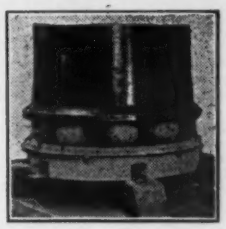

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LOADERS, Truck
Joy Manufacturing Co., Franklin Pa.

LOADERS, Wagon
Joy Manufacturing Co., Franklin, Pa.

LOADING BOOMS
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

LOADING MACHINES
The Coloder Co., Columbus, Ohio.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Myers-Whaley Co., Knoxville, Tenn.

LOCOMOTIVES, ELECTRIC
General Electric Co., Schenectady, N. Y.
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

LOCOMOTIVES, GASOLINE
Vulcan Iron Works, Wilkes-Barre, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

LOCOMOTIVES, RACK RAIL
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

LOCOMOTIVES, STEAM
Vulcan Iron Works, Wilkes-Barre, Pa.

LOCOMOTIVES, STORAGE BATTERY
General Electric Co., Schenectady, N. Y.
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Vulcan Iron Works, Wilkes-Barre, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

LOCOMOTIVE SWITCHING & WRECKING ROPES
John A. Roebling's Sons Co., Trenton, N. J.

LOCOMOTIVES (Third Rail)
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

LOCOMOTIVES, TROLLEY
General Electric Co., Schenectady, N. Y.
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.
Vulcan Iron Works, Wilkes-Barre, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

LONGWALL MACHINES
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

LUBRICANTS
Keystone Lubricating Co., Philadelphia, Pa.
Standard Oil Co. (Ind.), Chicago, Ill.

LUBRICATORS
Keystone Lubricating Co., Philadelphia, Pa.

MACHINE OILS
Standard Oil Co. (Ind.), Chicago, Ill.

MACHINERY, TRANSMISSION (Power)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y..

MANIFOLDS, OXYGEN
Oxweld Acetylene Co., 30 E. 42d St., New York City.

MAST ARM ROPE, Galvanized
John A. Roebling's Sons Co., Trenton, N. J.

METHANE RECORDER, CONTINUOUS
Mine Safety Appliances Co., Braddock Ave. and Thomas Blvd., Pittsburgh, Pa.

MILL GREASES
Standard Oil Co. (Ind.), Chicago, Ill.

MILLS, ROD & BALL
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

MILLS, STAMPS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

MINE CAR AXLES
American Car & Foundry Co., 30 Church St., New York City.
Hockensmith Wheel & Mine Car Co., Penn, Pa.

MINE CAR BEARINGS
Hyatt Roller Bearing Co., Newark, N. J.
Timken Roller Bearing Co., Canton, Ohio.

MINE CAR BOXES
American Car & Foundry Co., 30 Church St., New York City.
Hockensmith Wheel & Mine Car Co., Penn, Pa.

MINE CAR FORGINGS
American Car & Foundry Co., 30 Church St., New York City.
Hockensmith Wheel & Mine Car Co., Penn, Pa.

MINE CAR LUBRICANTS
Keystone Lubricating Co., Philadelphia, Pa.
Standard Oil Co. (Ind.), Chicago, Ill.

MINE CAR PARTS
American Car & Foundry Co., 30 Church St., New York City.
Hockensmith Wheel & Mine Car Co., Penn, Pa.
Phillips Mine & Mill Supply Co., Pittsburgh, Pa.

MINE CAR ROLLER BEARINGS
American Car & Foundry Co., 30 Church St., New York City.

MINE CARS
American Car & Foundry Co., 30 Church St., New York City.
Enterprise Wheel & Car Corporation, Huntington, W. Va.
Hockensmith Wheel & Mine Car Co., Penn, Pa.
Phillips Mine & Mill Supply Co., Pittsburgh, Pa.

MINE CAR WHEELS
American Car & Foundry Co., 30 Church St., New York City.
Hockensmith Wheel & Mine Car Co., Penn, Pa.

MINE DOORS, AUTOMATIC
American Mine Door Co., Canton, Ohio.

MINE LOCOMOTIVE CABLE
American Steel & Wire Co., Chicago, Ill., and New York.
General Electric Co., Schenectady, N. Y.
John A. Roebling's Sons Co., Trenton, N. J.

MINE TIES
Central Frog & Switch Co., Cincinnati, Ohio.

MINING & METALLURGICAL MACHINERY
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MINING EQUIPMENT
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York City.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Westingnouse Electric & Mfg. Co., East Pittsburgh, Pa.

MINING MACHINE CABLE
General Electric Co., Schenectady, N. Y.
John A. Roebling's Sons Co., Trenton, N. J.

MINING MACHINES
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York City.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

MINING MACHINES (Electric)
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MINING MACHINES (Government Approved)
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

MINING MACHINERY
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York City.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MINING MACHINERY BEARINGS
Hyatt Roller Bearing Co., Newark, N. J.

MINING SPECIALTIES
G. R. Delamater, 3233 Chadbourne Road, Cleveland, Ohio.

MOTOR OILS
Standard Oil Co. (Ind.), Chicago, Ill.

MOTORS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MOTORS, Electric
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MOUNTED BOTTOM CUTTERS
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

MOVING PICTURE CORD
American Steel & Wire Co., Chicago, Ill., and New York.
John A. Roebling's Sons Co., Trenton, N. J.

NITROGEN GAS
Linde Air Products Co., 30 East 42d St., New York City.

OIL RIGS, PORTABLE
Keystone Churn Drill Co., Beaver Falls, Pa.

OILS
Standard Oil Co. (Ind.), Chicago, Ill.

ORE, BUYERS AND SELLERS OF
Irvington Smelting & Refining Works, Irvington, N. J.

ORE, CARNOTITE & VANADIUM
O. Barlow Willmarth, Georgetown, Colo.

OVERCUTTING MACHINES
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

OXYGEN BREATHING APPARATUS, McCAA, TWO-HOUR
Mine Safety Appliances Co., Braddock Ave. and Thomas Blvd., Pittsburgh, Pa.

OXYGEN GAS
Linde Air Products Co., 30 East 42d St., New York City.

OXYGEN PUMP, HIGH PRESSURE
Mine Safety Appliances Co., Braddock Ave. and Thomas Blvd., Pittsburgh, Pa.

OXY-ACETYLENE APPARATUS and SUPPLIES
Oxweld Acetylene Co., 30 E. 42d St., New York City.

PAVING BREAKERS
Ingersoll-Rand Co., 11 Broadway, New York City.

PERFORATED METAL
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Hendrick Mfg. Co., Carbondale, Pa.

PERMISSIBLES, Explosives
du Pont Powder Co., The E. I., Wilmington, Del.
Hercules Powder Co., Wilmington, Del.

PETROLATUMS
Standard Oil Co. (Ind.), Chicago, Ill.

PICKING TABLES
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

PIPE (Genuine Wrought Iron)
A. M. Byers Co., Pittsburgh, Pa.

PIPE (Wood)
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

PNEUMATIC COAL SEPARATING MACHINERY
American Coal Cleaning Corp., Welch, W. Va.

PNEUMATIC SIZING MACHINERY
American Coal Cleaning Corp., Welch, W. Va.

PNEUMATIC TOOL
Ingersoll-Rand Co., 11 Broadway, New York City.

PNEUMATIC TOOL LUBRICANT
Standard Oil Co. (Ind.), Chicago, Ill.

PORTABLE TRACK
Central Frog & Switch Co., Cincinnati, Ohio.

PORTABLE TURNOUTS
Central Frog & Switch Co., Cincinnati, Ohio.

POST PULLERS, TEMPLE
Mine Safety Appliances Co., Braddock Ave. and Thomas Blvd., Pittsburgh, Pa.

POWDER BLASTING
E. I. Du Pont de Nemours & Co., Inc., Wilmington, Del.
Hercules Powder Co., 934 King St., Wilmington, Del.

POWER CABLES
American Steel & Wire Co., Chicago, Ill., and New York.
General Electric Co., Schenectady, N. Y.
John A. Roebling's Sons Co., Trenton, N. J.

POWER SHOVELS
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

POWER TRANSMISSION MACHINERY
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

PREHEATING APPARATUS
Oxweld Acetylene Co., 30 E. 42d St., New York City.

PRESERVATIVE EQUIPMENT
American Lumber & Treating Corp., 1138 Lake Shore Drive, Chicago, Ill.
United Wood Treating Corp., 1138 Lake Shore Drive, Chicago, Ill.

PRESERVATIVES, WOOD
American Lumber & Treating Corp., 1138 Lake Shore Drive, Chicago, Ill.
United Wood Treating Corp., 1138 Lake Shore Drive, Chicago, Ill.

PRESSURE GUN GREASE
Standard Oil Co. (Ind.), Chicago, Ill.

PROSPECTIVE DRILLS
Hoffman Bros. Drilling Co., Punxsatawney, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.
Pennsylvania Drilling Co., Pittsburgh, Pa.

PULLEYS
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

PULLEYS, BALL OR ROLLER BEARING
S K F Industries, New York City

PULLEYS, CLUTCH, FRICTION
S K F Industries, New York City.

PULLEYS, LOOSE
S K F Industries, New York City.

PULVERIZERS, COAL AND COKE
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

PUMPS, Acid Resisting
Ingersoll-Rand Co., 11 Broadway, New York City.

PUMPS, AIR LIFT
Ingersoll-Rand Co., 11 Broadway, New York City.

PUMPS, Boiler Feed
Ingersoll-Rand Co., 11 Broadway, New York City.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

PUMPS, CENTRIFUGAL
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.
Keystone Churn Drill Co., Beaver Falls, Pa.

PUMPS, DEEP WELL
Ingersoll-Rand Co., 11 Broadway, New York City.
Keystone Churn Drill Co., Beaver Falls, Pa.

PUMPS (Electric)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

PUMPS, Fire
Ingersoll-Rand Co., 11 Broadway, New York City.

PUMPS (Gathering or Dip)
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

PUMPS, Inclined Shaft
Ingersoll-Rand Co., 11 Broadway, New York City.

PUMPS, MINE
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.

PUMPS, Sinking
Ingersoll-Rand Co., 11 Broadway, New York City.

PUMPS, PNEUMATIC AIR LIFT
Ingersoll-Rand Co., 11 Broadway, New York City.

PUMPS, POWER
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.

PUMPS, SAND
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.

PUMPS, STEAM
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.

PUMPS, VACUUM
Ingersoll-Rand Co., 11 Broadway, New York City.

PUNCHES, Drill Steel
Ingersoll-Rand Co., 11 Broadway, New York City.

QUARRYING MACHINERY
Ingersoll-Rand Co., 11 Broadway, New York City.

QUARTZ CRYSTAL
Diamond Drill Carbon Co., World Bldg., New York.

RADIO ACTIVE ORE
O. Barlow Willmarth, Georgetown, Colo.

RADIUM ORE
O. Barlow Willmarth, Georgetown, Colo.

RAIL BONDS
American Steel & Wire Co., Chicago, Ill., and New York.
General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, Ohio.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

RAIL BRACES
Central Frog & Switch Co., Cincinnati, Ohio.

RAILWAY SUPPLIES
General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, Ohio.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

RAMMERS, Pneumatic
Ingersoll-Rand Co., 11 Broadway, New York City.

RECEIVERS, AIR
Ingersoll-Rand Co., 11 Broadway, New York City.

REGULATORS, Welding and Cutting, Compressed Gas
Oxweld Acetylene Co., 30 E. 42d St., New York City.

REHEATERS, Air
Ingersoll-Rand Co., 11 Broadway, New York City.

REINFORCING BARS
Sweet's Steel Co., Williamsport, Pa.
West Virginia Rail Co., Huntington, W. Va.

RESCUE APPARATUS
Mine Safety Appliances Co., Braddock Ave. and Thomas Blvd., Pittsburgh, Pa.

RETARDERS
Mining Safety Device Co., Bowerston, Ohio.
Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

RIVER CROSSING SUSPENSION WIRE, Galvanized
John A. Roebling's Sons Co., Trenton, N. J.

ROCK-DISPOSAL EQUIPMENT
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

ROCK DRILLS
Diamond Machine Co., Monongahela, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.

ROCK DUSTING EQUIPMENT
American Mine Door Co., Canton, Ohio.
Diamond Machine Co., Monongahela, Pa.
Mine Safety Appliances Co., Braddock Ave. and Thomas Blvd., Pittsburgh, Pa.

RODS, WELDING
Ohio Brass Co., Mansfield, Ohio.
Oxweld Acetylene Co., 30 E. 42d St., New York City.

ROLLER BEARINGS
Enterprise Wheel & Car Corporation, Huntington, W. Va.
Hyatt Roller Bearing Co., Newark, N. J.
Timken Roller Bearing Co., Canton, Ohio.

ROLLS (Crushing)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

ROPE
American Steel & Wire Co., Chicago, Ill., and New York.

ROPE GREASE
Keystone Lubricating Co., Philadelphia, Pa.

ROPE, TRANSMISSION
American Steel & Wire Co., Chicago, Ill., and New York.
John A. Roebling's Sons Co., Trenton, N. J.

ROPE, WIRE
American Steel & Wire Co., Chicago, Ill., and New York.
John A. Roebling's Sons Co., Trenton, N. J.

ROTARY DRYERS
Vulcan Iron Works, Wilkes-Barre, Pa.

ROTARY COOLERS
Vulcan Iron Works, Wilkes-Barre, Pa.

ROTARY DUMPS
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Mining Safety Device Co., Bowerston, Ohio.
Phillips Mine & Mill Supply Co., Pittsburgh, Pa.
Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

ROTARY ROASTERS
Vulcan Iron Works, Wilkes-Barre, Pa.

RUNNING ROPE, Galvanized
American Steel & Wire Co., Chicago, Ill., and New York.
John A. Roebling's Sons Co., Trenton, N. J.

SAFETY APPLIANCES, MINE
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

SAFETY FUSE
Hercules Powder Co., Wilmington, Del.

SAND DRYERS
Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

SASH CORD
John A. Roebling's Sons Co., Trenton, N. J.

SAWS (Air)
Ingersoll-Rand Co., 11 Broadway, New York City.

SCRAPER LOADERS
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

SCREEN BARS
Phillips Mine & Mill Supply Co., Pittsburgh, Pa.

SCREENS (Anti-Gravity)
American Coal Cleaning Corpn., Welch, W. Va.

SCREENS, HORIZONTAL
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

SCREENS, PERFORATED METAL
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Hendrick Mfg. Co., Carbondale, Pa.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

SCREENS, REVOLVING
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Hendrick Mfg. Co., Carbondale, Pa.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

SCREENS, SHAKER
Hendrick Mfg. Co., Carbondale, Pa.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

SCREENS AND PERFORATED SHEETING
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

SCREENS (Vibrating)
American Coal Cleaning Corpn., Welch, W. Va.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

SCREENS & WASHERIES
American Rheolaveur Corporation, Wilkes-Barre, Pa.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

SELF-RESCUERS
Mine Safety Appliances Co., Braddock Ave. and Thomas Blvd., Pittsburgh, Pa.

SEIZING STRAND, GALVANIZED
John A. Roebling's Sons Co., Trenton, N. J.

SHARPENERS, DRILL
Ingersoll-Rand Co., 11 Broadway, New York City.
Sullivan Machinery Co., 122 S. Mich. Ave., Chicago, Ill.

SHEAVES
Hockensmith Wheel & Mine Car Co., Penn, Pa.
John A. Roebling's Sons Co., Trenton, N. J.
Vulcan Iron Works, Wilkes-Barre, Pa.

SHEAVE WHEELS
Diamond Machine Co., Monongahela, Pa.
Hockensmith Wheel & Mine Car Co., Penn, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.

SHORTWALL MACHINES
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Hyatt Roller Bearing Co., Newark, N. J.

SHOVELS, ELECTRIC
Myers-Whaley Co., Knoxville, Tenn.

SHOVEL—ELECTRO-HYDRAULIC
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

SIGNAL WIRES AND CABLES
American Steel & Wire Co., Chicago, Ill., and New York.
General Electric Co., Schenectady, N. Y.
John A. Roebling's Sons Co., Trenton, N. J.

SIGNS
Mine Safety Appliances Co., Braddock Ave. and Thomas Blvd., Pittsburgh, Pa.

SIGNS (Mine)
Stonehouse Signs, Inc., 842 Larimer St., Denver, Colo.

SINKERS, ROCK DRILL
Ingersoll-Rand Co., 11 Broadway, New York City.

SKIPS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Hendrick Mfg. Co., Carbondale, Pa.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.
Vulcan Iron Works, Wilkes-Barre, Pa.

SKIP LOADING EQUIPMENT
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

SLABBING MACHINES
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

SMELTERS
Irvington Smelting & Refining Works, Irvington, N. J.

SOCKETS, Open and Closed
John A. Roebling's Sons Co., Trenton, N. J.

SPECIAL MACHINERY
Vulcan Iron Works, Wilkes-Barre, Pa.

SPEED REDUCERS, DOUBLE
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

SPEED REDUCERS, SINGLE
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

SPIKES
Sweet's Steel Co., Williamsport, Pa.
West Virginia Rail Co., Huntington, W. Va.

SPLICE BARS (Plain and Angle)
Carnegie Steel Co., Pittsburgh, Pa.
Central Frog & Switch Co., Cincinnati, Ohio.
Sweet's Steel Co., Williamsport, Pa.
West Virginia Rail Co., Huntington, W. Va.

SPLICE, CABLE
American Mine Door Co., Canton, Ohio.
Ohio Brass Co., Mansfield, Ohio.

SPLICE, INSULATOR
American Mine Door Co., Canton, Ohio.

SPLICE, TROLLEY WIRE
General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, Ohio.

SPLICERS, TROLLEY
American Mine Door Co., Canton, Ohio.
Ohio Brass Co., Mansfield, Ohio.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

SPROCKETS, CLAMP HUB
Morse Chain Co., Ithaca, N. Y.

SPROCKETS, COMPENSATING
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

SPROCKETS (Shearing Pin)
Morse Chain Co., Ithaca, N. Y.

SPROCKETS, SILENT CHAIN
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

SPROCKETS, SPRING
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

SPUR GEAR DRIVES
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

STARTER CABLES
John A. Roebling's Sons Co., Trenton, N. J.

STEAM CYLINDER OILS
Standard Oil Co. (Ind.), Chicago, Ill.

STEEL, ALLOY
Timken Roller Bearing Co., Canton, Ohio.

STEEL CROSS TIES
Carnegie Steel Co., Pittsburgh, Pa.
Sweet's Steel Co., Williamsport, Pa.
West Virginia Rail Co., Huntington, W. Va.

STEEL, ELECTRIC FURNACE
Timken Roller Bearing Co., Canton, Ohio.

STEEL, HOLLOW AND SOLID DRILL
Ingersoll-Rand Co., 11 Broadway, New York City.

STEEL, NICKEL
Timken Roller Bearing Co., Canton, Ohio.

STEEL, NICKEL, MOLYBDENUM
Timken Roller Bearing Co., Canton, Ohio.

STEEL, OPEN HEARTH
Timken Roller Bearing Co., Canton, Ohio.

STEEL, REINFORCING
American Mine Door Co., Canton, Ohio.

STEEL, SHAPES, PLATES, BARS, ETC.
Carnegie Steel Co., Pittsburgh, Pa.

STEEL, Special Analysis
Timken Roller Bearing Co., Canton, Ohio.

STEEL TIES AND REINFORCEMENTS
Carnegie Steel Co., Pittsburgh, Pa.
West Virginia Rail Co., Huntington, W. Va.

STEPS. SAFETY STAIR AND LADDER
Hendrick Mfg. Co., Carbondale, Pa.

STOPERS, ROCK DRILL
Ingersoll-Rand Co., 11 Broadway, New York City.

STORAGE BATTERY LOCOMOTIVES
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Vulcan Iron Works, Wilkes-Barre, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

STRAND
American Steel & Wire Co., Chicago, Ill., and New York.
John A. Roebling's Sons Co., Trenton, N. J.

SWITCHBOARD WIRE AND CABLES
American Steel & Wire Co., Chicago, Ill., and New York.
John A. Roebling's Sons Co., Trenton, N. J.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

SWITCHBOARDS, POWER
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

SWITCHES
Central Frog & Switch Co., Cincinnati, Ohio.
Sweet's Steel Co., Williamsport, Pa.

SWITCHES, ALTERNATING
Mining Safety Device Co., Bowerston, Ohio.

SWITCHES (Disconnecting and Electric)
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

SWITCHES AND FROGS, TROLLEY
American Mine Door Co., Canton, Ohio.
Central Frog & Switch Co., Cincinnati, Ohio.
Ohio Brass Co., Mansfield, Ohio.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

TACKLE BLOCKS
John A. Roebling's Sons Co., Trenton, N. J.

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INDEX TO ADVERTISERS

	Page
Ahlberg Bearing Co	66
Allis-Chalmers Mfg. Co	39
American Car & Foundry Co	60
American Coal Cleaning Corp	82, 83
American Mine Door Co	15
American Rheolaveur Corp	84, 85
American Steel & Wire Co	100
Atlas Car & Mfg. Co	56, 57
Byers Co., A. M.	Inside Front Cover
Bethlehem Steel Co	58
Broderick & Bascom Rope Co	94
Carnegie Steel Co	Inside Back Cover
Central Frog & Switch Co	54, 55
Chance & Co., H. M.	87
Coloder Co., The	30
Connellsville Mfg. & Mine Supply Co	109
Curtin-Howe Corp	67
Delamater, G. R.	109
DeLaval Steam Turbine Co	74
Diamond Drill Carbon Co, The	111
Diamond Machine Co	101
Dupont de Nemours Co., E. I.	18, 19
Ellis Mill Co	111
Ensign-Bickford Co	100
Enterprise Wheel & Car Corp	63
Fairmont Mining Machinery Co	3
General Eelctric Co	34, 35, 36, 37, 38, 61
Goodman Mfg. Co	32, 50, 51
Grasselli Powder Co	20
Hazard Wire Rope Co	96
Hendrick Mfg. Co	111
Hercules Powder Co	10, 21
Hockensmith Wheel & Mine Car Co	65
Hoffman Bros	111
Hyatt Roller Bearing Co	59
Ingersoll-Rand Co	22, 42
Irvington Smelt. & Ref. Works	111
Jeffrey Mfg. Co	6, 7, 8, 9
Joy Mfg. Co	31
Keystone Lubricating Co	16

	Page
LaBour Co	75
Lehigh Coal & Navigation Co	113
Leschen & Sons Rope Co., A	93
Linde Air Products Co	107
Link-Belt Co	29, 80, 81
Lorain Steel Co	26, 27
Ludlow-Saylor Wire Co., The	89
Mine Safety Appliances Co	14
Mining Safety Device Co	97
Morse Chain Co	Back Cover
Myers-Whaley Co	28
National Carbon Co., Inc	43
New Departure Mfg. Co., The	69
Nuttall Co., R. D.	44
Ohio Brass Co	40, 41
Oxweld Acetylene Co	105
Patrick, R. S.	109
Pennsylvania Drilling Co	111
Pennsylvania Mining Machine Co	88
Phelps Dodge Corp	111
Phillips Mine & Mill Supply Co	64
Post Glover Co	46
Roberts & Schaefer Co	78, 79
Robinson Ventilating Co	72
Roebling's Sons Co., John A	92
Rome Wire Co	95
Sanford-Day Iron Works	102, 103
Standard Oil Co. (Ind.)	5
SKF Industries, Inc.	99
Stonehouse Signs, Inc	111
Sullivan Machinery Co	24, 25
Sweet's Steel Co	109
Thorne Neale & Co., Inc	113
Timken Roller Bearing Co	48, 49
Tyler Co., W. S., The	86
United Wood Treating Corp	68
Vulcan Iron Works	104
W. Va. Rail Company	62
Westinghouse Elec. & Mfg. Co	45, 52, 53
Willmarth, O. Barlow	117

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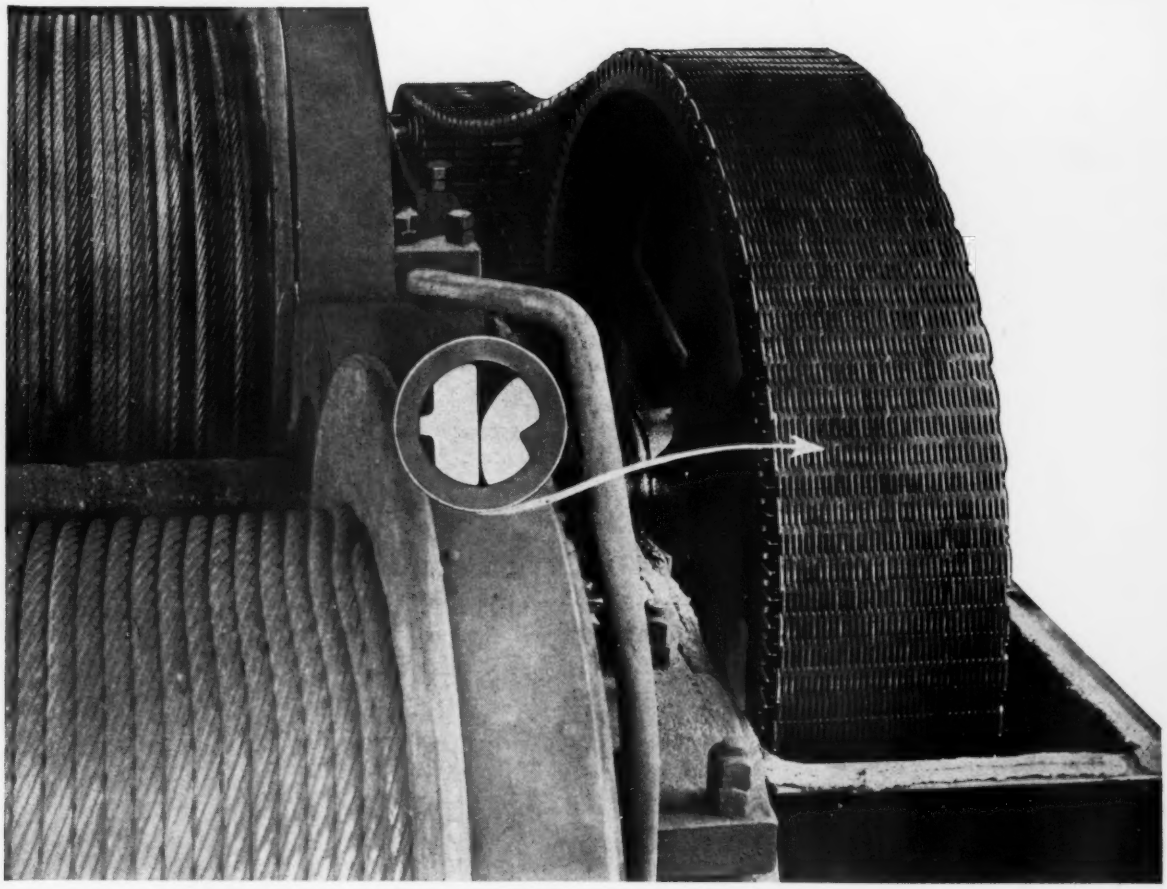

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